THE ENGINEERING AND MINING JOURNAL.

VOL. XV.—No. 6.—FOURTH SERIES. NEW YORK, TUESDAY, FEBRUARY 11, 1873. PRICE 10 CENTS PER COPY.

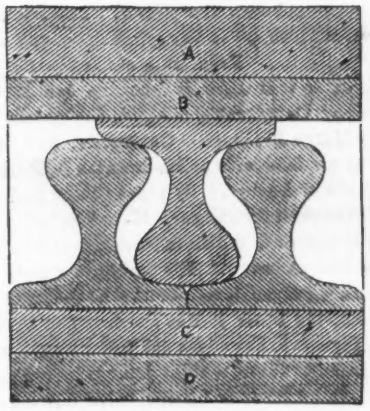
The Life of Iron Rails.*

I SUBMIT to the Club for consideration some facts concerning the actual service performed by what may be called the average iron rails used on the railroads of this country. Statements are often made as to the life of such rails, and the question is frequently asked, How long will iron last in the track? So many circumstances bear upon this question that it is impossible to give a definite answer. The grades and alignment of the road, the amount of traffic, the speed of trains and weight of engines are conditions that affect the solution of the problem; but besides these there is an unknown quantity which is not to be ascertained by any known formula—the particular quality, or want of quality, of the rails themselves.

The statistics which I present may be of interest by giving information as to the actual wear of a number of brands of rails, each from a different maker, and therefore fairly representing the average rails of the country.

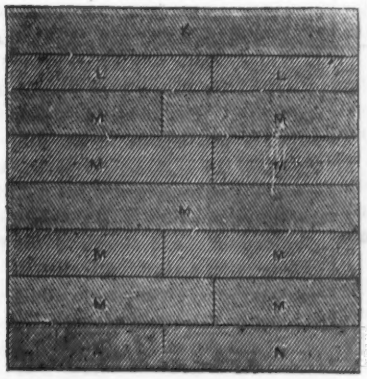
The road on which these rails were laid is 131 miles long; 77 per cent. of its length tangent, 21 per cent. with curves of less than 5 degrees, and 2 per cent. with curves of over 5 degrees. The grades are: level, 20 per cent.; less than 20 feet per mile, 20 per cent., and between 20 feet and 42 feet per mile, 60 per cent. Its yearly mileage of engines is about 1,000,000 miles. The engines used

No. 2.



A, Old Rail. B, Muck bar. C, Old rail. D, Old rail.

No. 6.
7½ inches wide.



K, Reheated muck bar. L, Muck bar. M, Old rail. N, Scrap iron.

weigh 30 and 32 tons, have four driving-wheels, and carry five tons on a wheel. The speed of passenger trains in motion is 24 miles per hour, and that of freight trains 15 miles. In justice to the rails, it ought to be added that if trains are behind time they will sometimes run at a greater speed than this.

Examination was made of several different lots of rails which had been in use 2¾ to 5 years. For convenience, I have numbered the different lots from 1 to 7, the numbers referring to the time when the rails were laid, No. 1 having been laid first and No. 7 last:

TABULAR STATEMENT OF SERVICE OF IRON RAILS.

	Total Number of Bars.	Per Cent. of Bars Still in Use. Good.	Battered.	Per Cent. of Bars Taken Out.	Years in Use.
No. 1	1,080	60	18	22	5
2	630	66	11	23	4
3	2,520	42	32	26	4
4	1,989	25	28	47	4
5	1,976	46	9	45	3¾
6	392	56	19	25	3
7	336	65	24	11	2¾

Rails No. 1 were made under the following specification:

"The rails are to be made of iron of good quality suitable for rails, and to be subject to the inspection of an agent of the railroad company in all stages of manufacture. No old rails are to be used in the manufacture of the said rails.

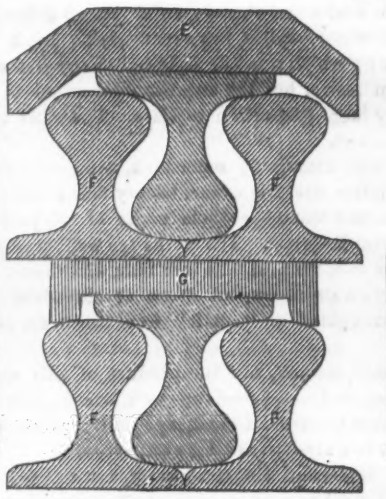
"The piles from which the rails are rolled are to have a top and bottom piece of reheated iron not less than an inch in thickness, running the whole length of the pile. The said tops and bottoms are to be manufactured from puddled flats not more than seven-eighth of an inch in thickness, and the whole process is to be carried on under the supervision of ——— ———, Esq., with the distinct understanding that he shall see that the iron is good, and the rails properly made, and will give his certificate accordingly."

Rails No. 2 were made from a pile 7½ inches base, 8½ inches high, made up of two flats at bottom and two flats at top, the space between these flats filled in with three pieces of old rails; the lower two flats and the top flat made from old rails, the second top flat from muck bar. Bottom flats each one inch thick, the top flat 1½ inches, and muck bar seven-eighth inch thick.

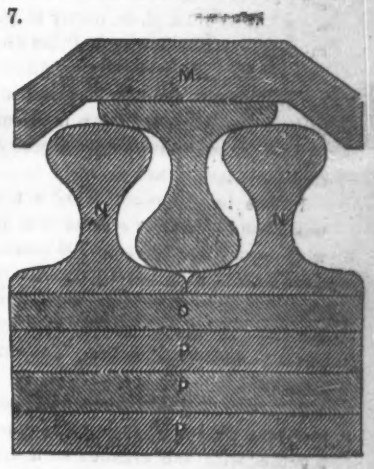
Nos. 3, 4 and 5 were made at different mills, under the same specification:

"The rails are to be made from a pile at least 8 inches by 8 inches, of which the head or top piece shall be composed of best No. 2—or reheated—iron, at

No. 7.



E, reheated muck bar, whole length. F, old rail, whole length. G, muck bar. This is the pile usually used.



M, reheated muck bar, whole length. N, old rails, whole length. O, muck bar P, P, P, old rails. This pile is used when short pieces of old rails have accumulated.

least two inches in thickness, made wholly from puddled bars puddled from pig iron, in which no cinder mine has been used; in other words, the pig iron used for the head piece shall be made from good native ore alone, without any admixture whatever of cinder. The remainder of the pile shall be put together so as to break joints, with as few short pieces of iron as possible, and of such quality as will give a good, tough, fibrous flange on the base. Both the head pieces and the rail piles shall be bloomed in the usual manner, and reheated to a good soaking heat before the final rolling. All the materials and processes employed in the manufacture of these rails shall be the same as if they were to be guaranteed for seven years, but in lieu of such guarantee the railroad company will trust to the honor of the makers to comply with this provision. An inspector may be sent to the works to supervise the manufacture of the rails and to pass them on final delivery; but if no inspector be provided, the manager of the works will consider this duty as confided to his honor."

No. 6 rails were made from a pile 7½ inches base, 7½ inches high, composed of 8 layers of flats each one inch thick, except the one next below the top plate, which was ¾ of an inch thick. The top flat and the fourth from the bottom were 7½ inches wide, the others were composed of pieces 3 inches and 4½ inches wide; the different flats breaking joints. The bottom piece was from scrap iron, the top piece of reheated muck bar, and the next below of muck bar.

The pile for No. 7 rails was composed of a base consisting of 3 pieces of old rails, 2 placed side by side and the third inverted between them; a muck bar ¾ inch thick rests on base of the inverted rail, with its ends turned down to rest on the outer pieces. Three old rails rest on this flat, arranged as in the base and a reheated muck bar 1¼ inch thick with ends turned down makes the head

NOTE.—We are indebted to the *Railroad Gazette* for the use of the cuts which illustrate this paper.

* A paper read before the Civil Engineers' Club of the Northwest, December 9, 1872, by L. P. MORRHOUSE.

This pile received six passes, rolling it into a bloom about 6 feet long and 5½ inches by 6 inches. It was then reheated, and afterwards rolled into a rail.

The rails originally laid are made from a pile 7 inches base and 7½ inches height, of six flats, each 1¼ inch thick and 7 inches wide, the one next above the bottom piece composed of short pieces 7 inches square and placed with the fiber at right angles to the direction of the pile. The top flat was made of a granular iron double-worked, the others of single-worked iron, the bottom flat being of good fibrous iron. The pile received four passes through box rolls at a speed of 18 inches per second, was then reheated to a welding heat and received eight passes through draft rolls at a speed of six feet per second, being worked edgewise through the draft rolls.

I cannot give exact data concerning the wear of these rails, but I find that after a service of 11 years 33 per cent. were in good condition. The mileage for these years was, however, less than that considered for the other rails, so that 5½ years' service of the latter would be equal to eleven years' service of the original rails.

The Illinois Patent Coke Works, at East St. Louis.

Among the important metallurgical works in the neighborhood of St. Louis, is the establishment, on the Illinois side of the Mississippi, known as the Illinois Patent Coke Company's Works. The stock of the company is largely, if not principally, owned by the brothers MEIER. Mr. T. G. MEIER is President, and the works are under the management of J. W. and E. D. MEIER. It has twenty-four ovens of the Coppée pattern, and with these is connected an excellent washing house, where the raw coal is crushed and the slate removed. To the description of the apparatus gathered there we will proceed first.

The coal used is slack from the Belleville, Duquoin, Chester, Big Muddy, and other mines. The last-named, as is well known, supply the only metallurgical fuel west of the Block coal area, and furnish the St. Louis works with their raw fuel. No distinction is made at the works between the varieties, and in consequence of the limited railroad facilities which so seriously derange the plans of all Western furnace men, the company has, during the winter, been glad to get coal, from whatever mine it may come. The Bellville coal contains a good deal of sulphur, partly in pieces large enough to give the coal-dresser no anxiety, but partly also in those fine scales and threads which are so difficult to dress out. Its structure is fine-laminar, and it has a tendency to break into small scales, or laminae—a peculiarity which must be regarded in any treatment of it. The top coal has a medium lustre, but the striated appearance of the bottom coal is indicative of a pretty large proportion of slate. The other varieties are intermediate between these two.

1. The buildings consist of a tower, containing water-tank, bins, etc., and a wash house. At one end of the latter are the ovens, twenty-four in number, with room for at least for 100 more, and along the whole length of the property runs a branch of the Illinois Central Railroad. The works are well situated in regard to transportation. From the cars the coal falls into bins, and thence to a shaking trough, which delivers it to a small conical drum of sheet-iron with one-half inch round holes. The throughfall or "small" from this drum is not crushed.

2. The coarse passes to a coffee-mill crusher, and the product of this unites with the "small" from the drum, and is carried up by a bucket elevator, together with the crushed stuff from the second crusher (a pair of rolls, to be spoken of hereafter). The elevator is sixty-four feet between centers.

3. From the buckets the coal is carried by a stream of water to the dust drum. This has one-sixteenth inch meshes, and the fine stuff is rejected. It is found to contain a very large percentage of slate—far above that natural to the coal. The drum has a two-inch pipe on each side, delivering jets of water through one-twentieth inch holes to wash the drum. The latter is nine-feet long, six feet being covered with fine netting, and three feet with coarser mesh. Everything below three-eighth inch passes through, and is washed to the sizing drum. The coarse passes through a tube to a preliminary jig in the crushing shed, the water used as the carrier coming from the settling basins. The object of this preliminary jig, which of course can do only rude work on unsorted stuff (three-eighth—two inch) is merely to separate the bits of iron and other hard substances which are always in ore or coal as it comes from the mine.

4. The purified coal passes over an inclined screen, where it drains, to the crushing rolls before mentioned as the second crusher. The rolls are chilled iron, and grooved in opposite directions, one parallel and the other vertical to the axes. The grooves are one-fourth inch deep and one-half inch wide, and the object of their right-angular disposition is to force the coal to a cubic fracture, instead of the lamellar one peculiar to it. Both coal and slate leave this machine with an excellent shape for washing. The crushed coal passes as before-said to the main elevator, thence to the dust drum, and finally to the sizing drum.

5. The sizing drum is conical, seventeen feet long, ends forty and sixty-six inches in diameter, and has three meshes, of one, two and three-tenths inch, giving four sizes in all. The first three sizes are each divided upon two double jigs, and the fourth to one double jig. On the first sieve of each jig fire-clay, pyrites and hard shale are removed. The second sieve separates out the fine interlaminated impurities and bituminous marls. These are really middlings, and the larger sizes could be recrushed and rewashed, but the operation would not pay under present conditions.

6. The fine coal from all the machines is collected in a straining drum, which has a double shell. Inside there are plates with one-eighth inch holes, and outside a No. 40 brass mesh drawn over plates with large holes. Though this is a draining drum, it is found best to supply it with water jets to keep the mesh clean.

7. From this the coal falls through a hopper to the smooth rolls which crush it fine, and thence to a second elevator, of fifty feet between centres, which lifts it to the coal tower, where there are two bins. The water from the straining drum, which carries along some very fine coal, goes to a settling basin where it has slow motion, and makes many abrupt turns. The clear water passes to the preliminary jig before spoken of.

The coal is left in the bins ten hours to drain, and is then dropped, by means of a simple slide, to buggies which are run under the bins. These buggies hold 1,100 pounds each, (1,000 lbs. coal and 100 lbs. water). They are run on rails to the ovens, each of which has three charging doors in the roof. The buggies are discharged by traps in the bottom, and the charge is raked over through holes in the oven doors, which remain closed. The new charge is made immediately after the old one is removed. The furnace is hot, gas is discharged from the coal and burns in the coking chamber, by the aid of air which enters through two-inch holes in the doors. The flame passes down the side flues and makes a double journey under the hearth, passing a distance of sixty feet in all. Even with this length of flue the flame is still bright at the flue during the first stages of the operation when the gas is abundantly given off. It is the intention of the Messrs. MEIER to use this gas, in new ovens, for making steam.

The ovens are thirty feet long, twenty-four inches wide, fifty-six and one-half inches to spring of the arch, and sixty and one-half inches to the crown. Each receives 5,500 pounds of coal. The time of coking is intended to be twenty-four hours, though the slack supply of coal this fall has compelled the managers to run a longer time, and the present furnaces are not adapted to a shorter operation than thirty-two hours.

The size of the jigs is such that one jig supplies four ovens, producing about 11 tons of cleaned coal in 24 hours. The sieves are 36x30 inches, and the pistons 36x24 inches, making 60 strokes per minute. Two machines are placed end to end, the second receiving its supply from the first sieve. The layer of coal is 8 to 10 inches thick, according to size. Belt connections transfer the power to a pulley placed on a crank shaft, over the first sieve, the crank-pin of which works in a slotted lever connected with the piston. This not only permits variation of the stroke at will, but also gives the quick down and slow up-stroke which is a main necessity in jigging. From this crank-shaft a rod passes to the piston of the second sieve, so that there is but one belt to two machines. The refuse is discharged by OSTERSPEY's method, the patent for which is controlled, in America, by MEIER Brothers. OSTERSPEY, who is in charge of the admirable dressing works for lead ores at Mechernich in Prussia, saw the disadvantages of the old methods of discharge by pipes passed through the sieves, or over a shelf placed under the shelf for gangue. He devised a means of taking off the discharge on the whole length of the sieve, which prevents side motion of the stuff, and also avoids loss of water. His device is simply the quadrant of a cylinder—in other words, a curved face, pivotted at the centre of curvature. One half of this face is solid, the other half is cut into teeth. The opening in the end of the jig, close to the sieve, has edges cut to the same curvature, so that when the solid face is turned to them a tight joint is formed, and neither refuse nor water can pass. But by revolving the valve down a few inches, the toothed portion is brought opposite the opening, and presents so many passages both for solids and fluids. The toothed openings are V shaped, so that one valve answers equally well for large or small material. The valve is the full length or width of the sieve, less about one inch, and is set in a cast-iron box bolted to the front of the machine. This box runs down to a point, where a trap is placed. By setting the valve properly, the machine will quickly fill the box with water; but once filled, there is no further loss of water. The refuse enters and settles to the bottom, without other effect than to return an equal bulk of water to the sieve. When it is full, the raising of the trap discharges the contents of the box. For machines which work upon a material in which the dense part forms but a small proportion of the whole, the economy of OSTERSPEY's discharge valve is evident. It has been tried with equal success in ore and coal washing.

But let us return to the ovens. They were built by a German engineer, and have defects which the present managers intend to remedy this spring. Their main fault is excessive thinness of walls. The walls are built of hollow brick, L shaped. By placing two of them together, reversed, it is evident that a square opening will be left in the centre. These openings form the flues of the ovens (of which there are 28 in each wall!). The distance from one coke chamber to another is not more than 13½ inches, and opposite the flues the wall is only ¾ of this. The result is that there is not brick-work enough present to retain the heat necessary for the prompt ignition of the new charge; the heat throughout the operation is not high enough. In other words, the *regenerative force* of the ovens is too small, and as a consequence the coke is porous. These, however, are defects that the Messrs. MEIER are well acquainted with, and propose to remedy in their new ovens.

The leakage of gas was so great and the regenerative force of the walls so

low that they were compelled to alter the walls of the end ovens and build them up solid, with from 7 to 12 flues, 4½×9 inches. These changes were so effective in improving the quality of the coke, and in reducing the time of burning, that the managers are confident of their ability to produce in their new furnaces, with 24 hours time, a coke that shall be much denser and therefore better suited to the larger metallurgical operations. That which they now make is of about the quality which is most prized in Europe for lead and copper works, and it would, without doubt, be found an admirable fuel for use in the far West. There is need of just such a fuel, and western metallurgists will do well to make a trial of the Meier coke, which they can procure with more than 500 miles less transportation than the Maryland coke requires.

The following assays will show what the value of some of the Illinois coal is, and the improvement made by washing them:

	Moisture and Gas.	Condensable vol. matters.	Ash.	Carbon.	Coke.
Pittsburgh, lump	8.93	21.24	7.00	62 83	69.83
Big Muddy, lump	14.00	17.11	2.12	66.77	68.89
Crude Slack, mixed	10.02	20.40	18.10	51.48	69.58
Duquoin, washed	8 33	27.37	9.13	55.17	64.30
Washed coal (before double jigs and sizing drum were put in)	9.27	26.70	11.20	52.83	64.03
Slack, from which the above was washed	10.02	20.40	18.10	51.48	69.58
Coal, greasy lustre, laminar	8.19	28.76	1.00	62.05	63.05
Same lump, dull black	9.69	29.82	4.00	56.22	60.22

The percentage of ash in the slack is from 13·25 to 23·25; average about 19 per cent. The washed coals have at the lowest 5 per cent., and usually 6½ per cent.

The defects of the plant as at first laid down compelled the Messrs. MEIER to undertake extensive improvements, amounting, in fact, to a reconstruction of the works. In doing this they developed many points of interest which it may be worth while to recall. Their first labor was the improvement of the ovens. Several of these were taken down, built up more solidly, and with fewer flues. These, with other improvements, resulted in the production of a much better baked coke than had before been made.

The water supply failing, a number of tube or "drive" wells were sunk, some 45, others 70 feet deep. These wells are two inches in diameter, and placed in two sets of 8 and 9, each set discharging into a common air-tight cistern. The pump draws from this cistern. The whole arrangement is exceedingly ingenious and practical. The wells are sunk in a creek bottom, and the supply is never-failing. The 17 wells supply about 260 gallons per minute, and a reserve set of 14 tubes is in the ground, capable of supplying 200,000 gallons daily, and ready for use when needed.

A flat shaking "sizer" or compound sieve had been put in, which, though less effective than the drum sieves, was better than none at all. Experiments on the different sizes produced by this machine showed:

	Slack.	Washed Coal.
No. 1 contained of ash	19·09	11·50
No. 2 " "	16·72	10·22
No. 3 " "	25·22	17·00
Average of washed coal in tower		13·35

No. 3 was the smallest. Sifting out the various sizes carefully by hand, the proportion of coal below one-tenth inch diameter was found to be 13·77 per cent., while its ash amounted to 24·9 per cent. The remaining 86·23 per cent. of larger sizes had only 16·96 per cent. of ash. This investigation led to the use of a dust drum and the rejection of the fine dust. The slack entering the drum was found to contain 18·1 per cent ash, and on leaving it, 17·18 per cent. The dust had 27·72 per cent. The washed coal had 11·2 per cent., an improvement of more than 2 per cent. over the shaking sizer.

The separating drum was next put in, and the amount of ash in the different sizes was as follows: No. 1, one-tenth inch, 7·25 per cent.; No. 2, two-tenths inch, 8·25 per cent.; No. 3, three-tenths inch, 9·57 per cent.; and No. 4, forty-two-hundredths inch, 8·53 per cent. Coal from tower (average of washed products), 9·05 per cent.

Next, the thickness of the coal layer on the sieves was gradually increased from 4½ to 10 inches. The single jigs were replaced by larger and double ones. The three sizes of washed coal then gave 7·10 per cent. of ash, and the coke 11·59 per cent.

The coke finally averaged below 10 per cent. ash and 1½ per cent. sulphur.

As to yield, experiments made on Big Muddy slack showed a yield of 78 per cent. of coke from the washed coal. This coal in beehive ovens yields only from 43 to 58 per cent.

An experiment on three cars of other coal gave a yield of 62·8 per cent. of the washed coal. The coke contained 12·45 ash, leaving 50·35 per cent. fixed carbon, or about 1 per cent. less than the average of Belleville slack.

The works of the Illinois Coke Company are worthy of attention for many reasons. They were built entirely on German models, by a German engineer, and the replacing of the machines by more practical American devices, has been an almost uninterrupted task, until now there is but one of the original machines left, and that is condemned. The defects in the first plant mainly consisted, as might have been expected, of time-consuming, inconvenient, and costly details. As now constructed, their washing works are practical, scientific, and efficient. Screening out the dust, sizing and washing on double jigs, are the three steps of their method. Their machinery is almost automatic, and works both well and cheaply. They have now eliminated from their works the errors of the first machinery, and only the badly-built furnaces remain. These they propose to replace with constructions better suited to the coal used, and when that is done the light coke made at present will be changed to a denser article, which will probably find a large demand from blast furnaces.

The Telegraph in a Storm.

January 5th was a day of mingled rain, wind, and severe cold, and the telegraph wires rapidly became so loaded with sleet, and so contracted with cold, as to snap. The *Journal of the Telegraph* gives an account of how the storm affected the wires of the Western Union Company. At 11.45 A. M. several of the Pittsburgh wires failed; at 12.40 P. M. New York lost Albany on every wire, except one on the Hudson River Railroad. The Erie Railway wires, save one working between 145 Broadway and the Grand Opera House, stopped working at 1.00; all the Southern wires were grounded or open by 1.30; and at 3.45 the last Eastern wire stopped working. The City Line wires had broken some time previously, and information arrived of the complete wrecking of the Fire Alarm and Police Telegraphs. The large poles now used in the city reach to the house-tops and carry 14 wires. The weight of the ice which had accumulated upon the wires, and the force of the gale, was sufficient to snap poles 45 feet long, 18 inches thick at the butt, and all over 8 inches thick at the top, set 6 feet deep in the ground, like a pipe-stem.

Notes on a Metallurgical Journey in Europe.

By JOHN A. CHURCH, E. M.

FREIBERG, CONTINUED FROM PAGE 69.

Cupellation is performed in a German hearth. It is divided into three stages, forming three separate operations. 1. The operation is stopped at the point at which the bismuth begins to oxidise. This takes place when the lead is so concentrated as to contain about 50 per cent. silver. 2. The rich lead is then removed to a new furnace and concentrated to about 85—90 per cent. silver. All the products contain bismuth and are treated for this metal. 3. Refining takes place at the Halsbrücke works, the products being also rich in bismuth.

Of the cupellation a good idea will be obtained from five operations, in 1869, which gave the following results:

Charge: Lead from Pattinsoning	286,165	pounds.
Products: Abzug	1,100	"
Abstrich	none.	
Red litharge	30,910	"
Bismuth litharge	4,290	"
Ordinary litharge	221,760	"
Lead scraps	3,410	"
Hearth	25,080	"

The working time was 463 hours, but this evidently does not include the time employed in preparing and drying the furnace. The average amount of lead cupelled was 552 pounds per hour; a very high figure, and due to the fact that towards 30 tons of lead are cupelled at each operation. Of fuel 4½ cords wood, 15,400 pounds brown coal, and 6,610 pounds bituminous coal were used; or per ton of lead, 0·03 cords wood, 108 pounds brown coal, and 46 pounds coal (7·7 per cent.)

Of the above products the red litharge is sold for paint; the litharge containing bismuth is treated for that metal; ordinary litharge is revived to lead, lead scraps are returned to the next cupellation, and the hearth is charged in the first fusion for lead.

Second Cupellation:—The rich lead is not weighed but usually from 1,300 to 1,800 pounds weight, are obtained at each operation. From this second cupellation, which is conducted like the first, the following products are obtained:

First litharge, containing 4 per cent. bismuth.

Second litharge containing 9—10 per cent. bismuth.

Hearth containing 9—10 per cent. bismuth.

The time is four to six hours, fuel 9,380 pounds coal.

The resulting silver is refined in a cupel furnace. It contains all the gold of the ores and products, and this is separated by the usual method of dissolving the silver in hot sulphuric acid. The gold remains as a residue, and the silver is precipitated by copper from the solution. The gold is ignited with saltpeter and melted with bisulphate of soda. The slag contains platinum, which is obtained from it in the chemical laboratory.

THE COPPER PROCESS.[2]

Hitherto we have followed the course of the operations as they are carried out at the Muldner works; now we will turn our attention to the Halsbrücke works where all the copper is extracted. The matte is subjected to one more operation, by which its percentage of copper is increased to 73—75 per cent. This is done by a peculiar process.

The first copper matte, according to analysis made in the Clausthal laboratory (and the specimen may be looked upon as a fair average, though the copper sometimes rises to 43 per cent.), is made up as follows:—

2 This account of the treatment of the copper products is taken from that by Professor Kuhlemann of the Clausthal School of Mines, in the Preuss. Zeitschrift für Berg, Hütten und Salinen Wesen, 1872.

Copper	32·9	Iron	19·5
Silver	0·25	Sulphur	23·8
Lead	15.		

Arsenic, antimony, zinc, nickel, cobalt, etc., in small quantities.

This is smelted in a reverberatory furnace with quartz and barium sulphate. By reduction the barium sulphate becomes barium sulphide, which, in presence of copper oxide, gives up its sulphur to the copper, takes oxygen, and forms a silicate with the quartz. This use of barium sulphate as a re-agent is intended to prevent the introduction of iron into the charge. Since metallic copper is not made, but copper sulphate instead, it is necessary to the purity of the latter that the resulting matte shall not contain more than 0·2 per cent. of iron. The matte is stamped and roasted in a reverberatory furnace, to 5 per cent. sulphur. This is over-roasting, for there is not enough sulphur left to make the basic copper sulphide which is desired. But over-roasting is necessary in order to oxidize the iron sufficiently to insure its removal. Sulphur is then added to the charge in the form, as above stated, of barium sulphate, and by this method copper matte, of a high degree of concentration, and of a purity that is hardly attempted elsewhere than at Freiberg, is obtained.

In roasting, the charge is 1,100—1,540 pounds of matte every three hours ; or 8,800—11,320 pounds in twenty-four hours. The furnace is kept cooler than with ores or other matte, because the copper matte is very liable to soften and sinter. Of coal 30—36 per cent. is used, but it is of very poor quality, containing 20—25 per cent. of ash.

The product contains copper oxide, basic copper sulphate, iron oxide, basic iron sulphate, metallic silver, silver oxide, lead sulphate, zinc oxide, nickel oxide, cobalt oxide, and arsenic and antimony salts.

This is fused in a reverberatory of the kind described when speaking of the preparatory operations. The sides, formed of clay and quartz sand, are repaired after every two or three operations, because the slag, being a singulo silicate, attacks them rapidly. The charge weighs 3,630—3,960 pounds. Immediately after charging the furnace is fired as hotly as possible for 4—5 hours, when the charge is stirred, and when the matte has settled, the scoria is raked off, the matte remaining behind. A second charge is immediately made, and when the scoria from that has been drawn off, a third. Not until the matte of three charges has collected is it tapped. Five charges are made in twenty-four hours. The following is the composition of a charge :—

Charge :—Roasted matte	100
Raw copper (from same operation)	14—27
Black copper (from same operation)	23
Barium sulphate	25—30
Raw quartzose dry ores	14—23

Sometimes fluor spar is added to make the slag more fusible.

Products :—Black copper, containing lead, 0·50—0·60 per cent. silver, 20—25 lead, 50—60 per cent. copper.

Concentrated matte : 0·29—0·40 per cent silver, 3—7 per cent. lead, 70—73 per cent. copper. This product is the one for which the operation is undertaken.

Copper matte : 0·30—0·40 per cent. silver, 9 per cent. lead, 60 per cent. copper.

Of these products the black copper and copper matte are returned raw to the same operation.

There was an *apparent* loss of 0·26 per cent. silver, and 0·05 per cent. copper, and an apparent gain of 21·85 per cent. lead, and 296·35 per cent. gold. This arises from the fact that both the dry ores and scoria contained lead and silver which was in too small quantitiy to be accounted for by the assayer, as in keeping the books of the establishment each process is charged and credited with the materials it receives and delivers on the same principle which govern the purchase of ores. The figures of loss and profit are, therefore, not real, but financial.

The resulting concentrated matte contained, by analysis :

Copper	76·4	Iron	0·14
Lead	4·2	Sulphur	14·05—95·08
Silver	0·29		

In this specimen the percentage of copper is somewhat above the average. An average matte contains 69—74 per cent. copper, 0·2 per cent. nickel and cobalt, and 0.5—1 per cent. arsenic and antimony.

This matte is now treated with hot sulphuric acid to extract the copper. It is first stamped dry and sifted through a mesh of about 32 to the square inch in order to separate the metallic copper always existing in a matte of so high a grade. This metallic copper, if allowed to remain, would pass through the dissolving process almost undissolved, since the time of that operation is calculated for the solution of copper oxide, which is much quicker than that of the metal. The powdered matte is then roasted dead in an Augustin muffle furnace that has three hearths, and is so arranged that the hot gases can be shut off wholly or partly from the middle hearth, the object being to protect the fresh charge from the action of the hot gases. If too hot, the matte might soften sufficiently to sinter. One charge only of 1,000 pounds is at one time in the furnace, which for six hours is kept quite dark, the heat being then increased for three hours to incipient whiteness, which is kept up for three hours more under constant stirring of the matte. The charge remains sixteen hours in the furnaces, and its sulphur is reduced to 1 per cent. The roasted ore should be bluish black from copper oxide and not reddish brown which would indicate iron oxide. Labor amounts to about six days to 2,000 pounds, and of coal, which must be of the best quality, 110—120 per cent. is consumed.

The roasted matte is sifted to remove the lumps formed in roasting. These enclose raw particles which would pass unchanged through the dissolving process and add to the amount of the argentiferous residues. These coarse particles are stamped and re-roasted ; the fine part is ground in mills and bolted. It consists of oxides of copper, iron, nickel, cobalt and lead, metallic copper, silver and gold, a small quantity of sulphates of copper and lead, and some arsenic and antimony salts.

When this is boiled with sulphuric acid the oxides are dissolved, but metallic copper, silver and gold mostly remain as a residue. If silver is dissolved it is re-precipitated by the copper present. Arsenic and antimony salts are broken up, the arsenic remaining in the liquor as free arsenious acid, and the antimony as antimonic hydrate which partly falls.

The solution of the oxides takes place in thick vats of hard lead, having a capacity of 1.25 cubic meters, or about 45 cubic feet. They are 1.1 meter high and 1.22—1·36 meters in diameter. Raw chamber acid of 49—50° B. is first introduced to the height of 0.36 meters, and super-heated steam is blown in until the liquor boils. This dilutes it somewhat. The powdered matte is gradually added by means of percussion troughs, during which the whole is stirred constantly. One of the drawbacks of the Freiberg method is the tendency of the matte to lump together, thus increasing the amount of residue. Boiling is continued for an hour and a half, when the vat is filled up with mother liquor from the crystallization tank, and the boiling continued. The solution then marks 32° B. It is allowed to settle for two hours, and the clear liquor is then drawn off by a syphon to the clarifying vats, and afterwards to the crystallization tanks. The entire operation lasts five hours, and with four dissolving vats 3,630 pounds of matte are treated in twenty-four hours,

Crystallization continues for nine days. The first vitriol formed—about one quarter of the whole—goes to the market as raw vitriol. The remaining three quarters is re-dissolved, filtered through granulated copper to remove the insoluble residue, and also precipitate any silver that may be in solution, and recrystallized. This operation also takes nine days. The new liquor is nearly neutral, and the crystals are very large ; they are washed to remove a brown coating, and dried.

The yearly production is about 2,300,000 pounds, from 880,000 pounds of matte. The number of vats is eight, and of crystallization tanks 104.

The mother liquor is concentrated by boiling, and a new crop of crystals taken. These contain 0.035 per cent. of iron. The mother liquor is now very rich in iron, but it also contains two pounds of copper to the cubic foot. It is used as a cementing liquor in making fine pyritiferous ore into bricks. By this means the copper is returned to the process.

The Residues contain the silver. They are washed, filtered and dried, and form about 17 per cent. of the concentrated matte. Their composition in 1869 was about 1.94 per cent. silver, 41 per cent. lead and 11 per cent. copper ; but the proportion of copper has since then been reduced to 5 per cent. by using stronger acid. The percentage of lead is large, because the sulphate of this metal is entirely insoluble, and lead sulphate is formed by the action of the sulphuric acid. These residues are added to the first fusion for lead.

The balance sheet, reckoned upon 100 parts by weight of concentrated matte, is as follows :

Charge :—Concentrated matte	100
Sheet copper	22—122
Raw chamber acid reduced to 66° B (by weight)	196·7—196·7
Products :—Copper sulphate	251·38
Residues	16·41
Mother liquor=3 pounds cubic inch 1 cubic foot	68 cubic feet
Do. do. ferruginous, for bricks, 2lbs copper per cubic foot	180 ,,
Labor :—Roasting, days of twenty-four hours, 16	
Extraction, ,,	7·55—23·55
Fuel :—Roasting	116·6
Heating boiler	124·5
,, liquor	100·8
Drying crystals	20·0
,, residues	6·3—368·2

If to the above 251·38 cwt. of copper sulphate from 100 cwt. of concentrated matte we add the 8 cwt., to be extracted from the 68 cubic feet of 3-pound mother liquor, we have a total of 259·38 cwt. of copper sulphate from 71·5 cwt of copper in the matte. The make is, therefore, 362·8 per cent. 100 parts of copper therefore require 176·1 parts of acid of 66° B, and make 362·8 parts of copper sulphate. This proportion of acid is 21·5 parts in excess of that demanded by chemical laws, an excess which is accounted for by the acid taken up by the lead oxide.

It should be remembered that the coal used contains for the most part 20—30 per cent. of ash ; the remainder holding 8—10 per cent. All of it has about 8 per cent. of water.

The loss amounted to 3·19 per cent. gold, 0·65 per cent silver, and 0·64 per cent. copper. The gain was 20·48 per cent. lead, these amounts, as before said, not representing real loss or gain, but the commercial values of the materials treated and the products obtained.

(TO BE CONTINUED.)

THE COAL TRADE.

NEW YORK, February 6, 1873.

There is little to report in the coal business this week. The anthracite trade continues quiet, with perhaps a slight improvement.

Circular No. 25, of the New Jersey Central Railroad, announces that from February 1, the following tolls per ton, will be charged by this company, on coal shipments from Penn Haven, Mauch Chunk and Phillipsburg, to the several tide points named.

	From Penn Haven.	From Mauch Chunk.	From Phillipsburg.
Mauch Chunk	$0.13		
Phillipsburg	0.90	$0.77	
Elizabethport	2.04	1.91	$1.14
Port Johnston	2.04	1.91	1.14
Newark	2 40	2.27	1.50
Hoboken	2.04	1.91	1.14

The rate on coal for way points on the New Jersey Railroads, will be $1.15 per ton from Mauch Chunk to Phillipsburg. The above tolls do not include Wharfage or shipping expenses at tide ports.

The *Miner's Journal* of Pottsville speaking of the late advance in prices says:

"The Coal Mining and Transportation Companies evidently have an understanding that the prices of coal shall be put as speedily as possible, to the basis prices on which wages are to be paid. This is right. The basis for wages is not too high, particularly for labor, but is a fair rate, and would not have been acceded to by the men, if they did not believe that prices would advance a shade above the rates established, by which they are to receive a proportionate benefit. The average price of coal last year was $2.14‡ per ton. To raise the price of coal to the basis on which wages are to be paid, $2.50 and $2.75 per ton, it will require an advance of 45 to 47 cents per ton over the average of last year's prices in this region."

The Philadelphia Coal and Iron Company have taken the North Franklin Coal Company's collieries at Treverton. They are also preparing to take another colliery in the Mahanoy Region.

The Bituminous trade is in an almost complete dead lock. Scarcely any coal is coming forward, the scarcity of transport on the Pennsylvania road completely nullifying the preparations so energetically made for a steady supply, throughout the winter, by rail. The Baltimore harbor is nearly blocked up by ice, and coal in New York sells for $13 and $14 a ton by the cargo. With freight at $4.75 from Baltimore, it can hardly be sold at less than $13. The advance for the last two weeks has been therefore from $7.50 to $9, and again to $14. As for gas coal there is not enough to stock a professor's cabinet.

The strike in the Tuscarawas Valley, Ohio, now comprises about 7,500 men, and many iron works are forced to stop for want of coal. Some efforts have been made to replace the men on strike by colored laborers brought from Virginia. Three hundred are at work in the Bowers mine, and the experiment succeeds so well that other proprietors will probably follow suit.

Anthracite Coal Trade for 1871 and 1872.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending Feb. 1, 1873, compared with the week ending Feb. 3, 1872.

COMPANIES.	1872. WEEK.	1872. TOTAL.	1873. WEEK.	1873. TOTAL.
*Phila & Reading R.R†	31,765	434,674	45,783	513,932
*Schuylkill Canal	...	13,356	...	6,594
*Lehigh Valley R. R.	32.153	468,376	47,819	405,118
Lehigh & Sus. R. R.	21,878	121,660	28,296	153,893
Lehigh Canal	....	...	...	....
Scranton North	10,578	61,859	14.329	58,200
" South	26,653	190,929	27,025	153 397
Penn. Coal Co., rail	21,091	83,935	7,329	62,335
" " canal	....	...	....	....
Del. & Hud. Canal Co.	....	....	....	....
" " East	6,044	55,109	1,403	28,732
" " West	5,965	54,350	3,145	31,842
" " South	6,535	35,239	5,153	28.911
Shamokin	1.334	23,275	7,678	42,434
Treverton	....	.....	....	....
Lykens Valley Coal Co.	....	....	....	....
Wyoming North	....	.....	....	....
Wyoming South	....	.....	....	....
P. N. Y. C. & R. R. Co.	....	....	7,226	83,970
Williamstown Co'y	....	....	....	....
Big Lick Col	....	....	....	....
Total	163,996	1,522,432	194,877	1,569,358
1870			163,966	1,522,432
Increase	..		30,911	46,926
Decrease				

* These figures are for the week and fiscal period commencing Nov. 30.

† Less coal transported for Company's use and Bituminous coal.

Bituminous Coal Trade, 1871 and 1872.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending Feb. 1, 1873, compared with week ending Feb. 3, 1872.

COMPANIES.	1872. Week.	1872. Year.	1873. Week.	1873. Year.
C. & O. Canal	....	....	....	....
B. & O. R. R.	17,199	85,617	18,957	87,555
Penn. S. Line	....	.....	2,045	7,712
H. & B. T. R. R.	....	17,941	....	25.281
*Harrisburg & D	5,939	77,589	4,659	44,018
*L. V. R. R.	....	....	345	3,675
P. & N.Y.C. & R. Co.	4,744	48,698	1,130	40,156
Cumberl'd Branch Canal	....	....	....	....
" Railroad	....	....	2,428	6,516
Total	27,882	229,945	29,564	214,913
		214,913	27,882	
Decrease		15,032		
Increase			1,682	

Penn. and N. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending February 1, 1872.

	Week. Tons. Cwt.	Total. Tons. Cwt.
Anthracite received:		
From Lehigh Valley R. R.	5,168 04	50,415 08
" Lack. & B. R. R.	....	5,203 13
" Pleasant Valley R. R.	1,707 04	22,620 04
" Sul. & Erie R. R.	360 19	5 730 12
Total	7,226 07	83,969 17
Same time last year	10,211 14	80,700 13
Increase		3,269 04
Decrease	2,785 07	
Distributed:		
To Lehigh Valley R. R.	140 17	6,142 08
To Lack. & B. R. R.	....	201 04
To S. Central R. R.	1,958 08	17,321 09
To Ithaca & A. R. R.	1,024 15	11,669 05
To Erie R. W. Pockets for shipm't.	1,558 09	24,144 01
To individuals on line of road	739 18	8,717 14
To points at & above Coxton for use of Co.	567 00	4,629 12
To points between Waverley and Elmira	1,247 00	11,144 04
Total	7,226 07	83,969 17
Bituminous received from BARCLAY R. R.		
Shipped north from Towanda	1,130 12	40,155 17
Shipped south from Towanda	....	228 07
Northern Central R. R.	....	
Total	1,130 12	40,384 04
Same time last year	4.744 04	48,697 12
Increase		
Decrease	3,613 12	8,313 08
Distributed:		
To Erie Railway	945 07	32,362 03
To So. Central R. R.	185 05	7,699 09
To Ithaca Valley R. R.	....	71 08
Lehigh Valley, R. R.	....	142 13
To individuals on line of Railroad.	....	66 19
To points on line of road for use of Company		41 12
Total	1,130 12	40,384 04
Grand totals transported		
Anthracite	7,226 07	83,969 17
Bituminous	1,130 12	40.384 04
Total	8,356 19	124,354 01
Same time last year	14,956 18	129,398 05
Increase		5,044 04
Decrease	6,598 19	

Report of Coal Transported over Central R.R. of N. J. (Lehigh and Susq. Div.)

Week ending February 1—Compared with same time last year.

WHERE SHIPPED FROM	WEEK 1872., tons ct.	WEEK 1871. tons ct.	YEAR 1872 tons cwt.	YEAR 1871. tons cwt.
Wyoming Region	28419 12	23693 11	132617 17	109174 01
Upper Lehigh Region	2971 08	3657 14	16390 14	15773 02
Beaver Meadow Region	698 03		14499 18	5309 09
Hazleton Region	349 10	218 18	1339 18	1107 14
Mauch Chunk Region	2844 01	107 01	21937 16	17284 09
Tresckow Region				
Mahanoy Region				
Totals	35282 14	27682 04	192786 03	148618 09
Increase	7600 10		44167 14	
Decrease				
DISTRIBUTION.				
Forwarded East of Mch Chunk by Rail	28296 05	21878 10	153892 15	121660 07
Forwarded East of Mch Chunk by Canal				
Delivered at and above Mauch Chunk	1114 18	1245 11	8787 18	6811 12
L. V. R. R. at Packer'n	633 19	44 06	4128 03	1278 12
Delivered to L. & B. R. R. at Plymouth Bridge	1219 16		8128 16	
	4017 16	4513 17	17848 13	13867 18
Totals				
Of the above there was transported on acc'nt of L. C. & N. Co.	6667 04	271 07	52403 03	21573 03
W.-B. C. & I. Co.	16744 15	18131 00	70302 00	78919 05
Totals	23411 19	18402 07	122705 03	100492 08
Increase	5009 12		22212 15	
Decrease				

Northern Central Railway, Shamokin Division.

Below is the return of Coal sent over the Shamokin Division of the N. C. R. W., for the 7 days ending January 31, 1873.

	Tons.	Cwt.	
East	207	02	
West	7,471	01	
			7.678 03
Same time last year			1,333 18
Increase			6,344 05
Decrease			
Total amount shipped to date			42,433 16
Same time last year			23,275 04
Increase			19,158 12
Decrease			

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, Feb. 1, 1872.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons.	Cwt.
From St. Clair	17	16
" Port Carbon	2,817	17
" Pottsville	2,048	19
" Schuylkill Haven	23,162	03
" Pine Grove	378	02
" Tamaqua	7,911	10
" Harrisburg		
" Dauphin	53	12
Total	36,389	19

FOR SHIPMENT BY CANAL.

Passing Frackville Scales		
" Mill Creek "		
" Schuylkill Valley Scales		
" Mt. Carbon "		
" Cressona "		
" Pine Grove "		
" Tamaqua "		
Total		

SHIPPED WESTWARD VIA CATAWISSA AND WILLIAMSPORT BRANCH AND NORTHERN CENTRAL RAILROAD.

Via Catawissa & Williamsport Br.	330 01
" N. C. R. R. passing Locust Gap	458 11
" " " Shamokin	3,168 12
" " " Herndon	....
Total	3,957 04

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	227 04
" Lebanon & Pine Grove Branch	273 04
Total	500 08

CONSUMED ON LATERALS.

From Frackville Scales	.....
" Mill Creek "	521 01
" Schuylkill Valley Scales	486 04
" Mt. Carbon "	1,191 03
" Cressona "	492 17
" Pine Grove "	94 16
" Tamaqua "	665 05
Total	3,453 06

LEHIGH AND WYOMING COAL.

Received via Silverbrook Junction, Sent East	893 05
" " Cat. & Wpt. Br. Sent West	4 17
" " Rupert, Cat. & Wpt. Br.	....
" " Allentown, E. Penn'a Br.	51 15
" " Alburtis, " "	....
" " Oreland, G. & N. Br.	516 19
" " Connecting R. R.	....
" " Willow Street R. R.	215 00
Total	1,681 16

BITUMINOUS.

From Harrisburg	4,628 18
" Connecting R. R., G. & N. Br.	....
" Junction R. R.	30 00
Total	4,658 18

COAL FOR COMPANY'S USE.

Anthracite	4,718 00
Bituminous	321 17
Total	5,039 17

RECAPITULATION.

	Total for Week.	Corres-p'g week last year.	Increase and Decrease.
Passing over Main Line and Leh. Val. Branch	36,389 19	24,041 00	i 12,348 19
For Shipment by Canal			
Shipped Westward via Northern Central R. R.	3,957 04	3,292 08	i 664 16
Shipped West or South from Pine Grove	500 08	826 18	d 326 10
Consumed on Laterals	3,453 06	2,862 11	i 590 15
Lehigh and Wyoming Coal	1,481 16	743 08	i 738 08
Total Anthracite paying freig't	45,782 13	31,765 05	i 14,017 08
Bituminous	4,658 18	5,959 02	d 1,260 04
Total of all kinds paying freig't	50,441 11	37,704 07	i 12,737 04
Coal for Company's use	5,039 17	2,592 03	i 2,447 14
Total Tonnage for Week	55,481 08	40,296 10	i 15,184 18
Previously this year	556,410 18	566,944 18	d 534 00
Total to date	621,892 06	607,241 08	i 14,650 18

SHIPPED BY CANAL.

From Schuylkill Haven			
" Port Clinton			
Total Tonnage per Week			
Previously this year			
Total to date	6.594 00	13,355 16	d 6,761 16

Lehigh Coal and Navigation Company,

Report of Coal transported over the Lehigh Canal and L. & S. Div of Central Railroad of New Jersey for the week ending Feb. 1, 1873, and for the year 1873.

	WEEK.	YEAR.
Forwarded East of M'ch Chunk by Rail	28,296 05	153,892 15
Delivered at and above do.,	1,114 18	8,787 18
Forwarded East of do., by Canal	.....	.....
	29,411 03	162,680 18
Corresponding period last year—		
Forwarded East of M. Chunk by Rail	21,878 10	121,660 07
Delivered at and above do.,	1,245 11	6,811 12
Forwarded East of do., by Canal	.....	.....
	23.124 01	128,471 19
Increase on Railroad	6,287 04	34,208 14
Decrease " "	.....	.....
Increase on Canal	.....	.....
Decrease " "	.....	.....
Of the above there was transported on account of—		
Lehigh Coal Nav. Co	6,667 04	52,403 03
Wilkesbarre Coal & Iron Co	16,744 15	70,302 00
	23,411 19	122,705 03
Corresponding period last year—		
Lehigh Coal & Nav. Co	271 07	21,573 03
Wilkesbarre Coal & Iron Co	18,131 00	78,919 05
	18,402 07	100,492 08
Decrease	5,009 12	22,212 15
Increase.]		

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware, Lackawanna, & Western Railroad for the week ending Saturday, Feb. 1, 1873.

	WEEK. Tons. Cw	YEAR. Tons. Cwt.
Shipped North	14,329 07	58,200 04
Shipped South	27,025 04	153,397 04
Total	41,354 11	211,597 08
For the Corresponding time last Year:		
Shipped North	10,578 03	61,858 14
Shipped South	26,653 03	190,929 03
Total	37,231 06	252,783 17
Increase	4,123 05	
Decrease	.....	41,186 09

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending Feb. 1, 1873, with totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Total Wyoming	2,056 11	93,243 18
" Hazleton	31,0 9 08	247,147 02
" Upper Lehigh	138 12	636 09
" Beaver Meadow	10,307 00	93,334 17
" Mahanoy	5,121 16	44,468 02
" Mauch Chunk	28 13	251 18
Total	55,6 4 09	481,084 06
Same time last year	39,502 16	531,049 16
Increase	16,181 13	
Decrease		49,965 10
Forwarded East from Mauch Chunk by rail	47,518 18	405,118 28
Same time last year	32,153 08	468,376 07
Increase	15,365 10	
Decrease		63,257 19
DISTRIBUTED AS FOLLOWS.		
Forwarded East from Mauch Chunk by rail	46,455 02	396,612 12
do East for use L. V. R. R.	1,063 16	8,505 16
Delivered at and above Mauch Chunk for use of L. V. R. R.	1,598 00	11,281 02
To P. & N. Y. R. R.	5,156 04	50,415 15
To N. C. R. R. at Mount Carmel		952 19
To D. H. & W. R. R.	583 05	5,5 6 07
To L. & S. R. R. at Packerton for rail	484 12	2,472 14
Delivered at M'h Chunk	105 17	772 09
Delivered on line of road above Mauch Chunk	145 13	2,971 09
To L. S. & R. R., at Penn Hav., for railroad		1,541 10
Do. for canal		
To Lehigh Canal Mauch Chunk		35 00
To Catawissa Railroad		
Total	55,684 09	481,084 06

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday Feb. 1, and during the year 1873, compared with the corresponding period of 1872.

WEEK.

	C. & O. C'l Tons. Cwt	B. & O. R. R. Tons. Cwt.	Pa. R. Line Tons. Cwt.	Total Tons. Cwt.
1872	—	18,956 15	2,045 02	21,001 17
1871	—	17,199 05	....	17,199 05
Increase	.....	1,757 10	2,045 02	3,802 12
Decrease	—	....	....	

YEAR.

1872	—	87,555 07	7,711 12	95,266 19
1871	—	85,817 05	....	85,817 05
Increase	....	1,938 02	7,711 12	9,649 14
Decrease	—	....	....	....

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons. Cwt.	To B. & O. R. R. Co Tons. Cwt.	Total. Tons. Cwt
1873	—	2,427 16	2,427 16
1872	—		
Increase	—	2,427 16	2,427 16
Decrease	.....	....	.....

YEAR.

1873		6,516 07	6,516 07
1872			
Increase		6,516 07	6,516 07
Decrease			

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending February 1, 1873.

	1873. WEEK.	1873. YEAR.	1872. WEEK.	1872. YEAR.
By Railway	7,320 03	62,335 97	21,0 0 11	83,605 07
" Canal	....	....	....	....
Total				
Decrease 1873.	21,270 00			

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, February 1, 1873.

	WEEK.	SEASON
North	35,256 19	176 444 05
South	5,153 09	28,910 15
Total 1873	40,410 08	205,355 00
Corresponding time in 1872:		
North	45,630 13	229,528 04
South	6,534 16	31,415 09
Total	52,165 09	260,943 13
Increase North		
Decrease No th		
Increase south		
Decrease South		
Decrease	11,755 01	55,588 13

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending, Saturday, February 1, 1873.

	WEEK.	SEASON.
By Delaware and Hudson Canal	....	....
By Railroad, East	1,403	28,732
" West	3,145	31,847
" South	5,158	28,911
Total 1872	9,704	89,485
Corresponding time in 1871:		
By Delaware and Hudson Canal	....	....
By Railroad, East	6,014	55,109
" West	5,965	34,350
" South	6,635	35,239
Total	18,544	124,698
Decrease	35,213	

Prices of Coal by the Cargo.

(CORRECTED WEEKLY.)

	AT NEW YORK. February 7.		AT PHILADELPHIA. February 7.	
SCHUYLKILL.	R. A.	W. A.	R. A.	W. A.
Lump	$— —	$— —	— —	
Steamer	— —	— —	— —	— —
Broken	— —	— —	— —	
Egg	— —	— —	— —	— —
Stove	— —	— —	— —	— —
Chestnut	— —	— —	— —	
Pea	— —	— —	— —	— —
LEHIGH.				
Freight to New York 50 cents.				
Lump, (on board)	— —	5 00	— —	— —
Broken	— —	4 75	— —	— —
Egg	— —	4 75	— —	— —
Stove	— —	5 10	— —	— —
Chestnut	— —	4 15	— —	—
Pea	— —	— —		
SPECIAL COALS.				
Honey Brook, L. & W. A.	4 15@5 10		— —	— —
Spring Mountain " "	— —@— —		— —	— —
Sugar Creek " "	— —@— —		— —	— —
Sugar Loaf " "	— —@— —		— —	— —
Old Comp'y's " "	4 15@5 10		— —	— —
Room Run " "	4 15@5 00		— —	— —
McNeal " "	— —		— —	— —
Girardville " "	— —		3 10@4 00	—
Hill & Harris " "	— —		— —	— —
Shamokin " "	— —		— —	— —
Lykens Valley " "	— —		— —	— —
Broad Top " "	— —		3 25@4 25	— —
McMichael " "	— —		— —	— —
Henry Clay " "	— —		— —	— —

Company Coals.

February, 1873.

	L.	Str.	Gra.	Eg.	Sto.	Chest
*Scranton at E. Port	4 00	3 95	4 10	4 60	5 00	3 90
Pittston at Weehawken	4 40	4 40	4 40	4 40	4 80	4 40
*Lackawanna at Weehawken	4 20	4 20	4 40	4 65	5 10	4 30
Wilk'b're at Hoboken	4 25	4 35	4 45	4 70	5 15	4 35
Old Co. Lehigh at Pt. John'n	5 25	—	4 85	4 90	5 15	4 15
Lehigh at Eliz. Port	5 00	—	4 75	4 75	5 10	4 15

For freights to different points see "Freights."
*To contractors only.

Prices at Baltimore—February, 1873.

Wholesale Prices to Trade.

Wilkesbarre, by cargo or car load	$5 25@5 60
Pittston and Plymouth, do	5 25@5 50
Shamokin Red or White Ash, do	5 50@5 75
Lykens Valley Red Ash, do	6 25@6 50
Zerba Valley	
Treverton	
By retail, all kinds per ton of 2,240 lbs	7 25@7 50
George's Creek and Cumberland f. o. b. at Locust Point for cargoes	@4 75
Fairmont and Clarksburg gas f. o. b. at L. Point	5 00
BITUMINOUS COALS.	
Kittaning Coal Co.'s Phœnix Vein, f. o. b. at Phila	$
Lemon " " "	
Cumberland Vein Coal	....
Consolidation Coal Co.'s on board at Baltimore	....
Maryland Coal Co "	....

Prices at Georgetown, D.C., and Alexandria, Va.

February, 1873.

George's Creek and Cumberland f. o. b. for shipping $....@.... [nominally.

No coal before spring.

Prices at Havre de Grace, Md.

February, 1873.

Wilkesbarre and other White Ash for Cargoes	$ @4 75
Lykens Valley	@5 75
Shamokin Red or White Ash	5 00

Bituminous Coals (Cumberland).

Georgetown, F. o. b	$
Baltimore "	
New York "	

Prices of Foreign Coals.

February, 1873.

Duty 75 c. per ton.

Corrected weekly by ALFRED PARMELE, No. 32 Pine street, N. Y.

Liverpool Gas Coking	Nominal.
" " Cannel	15 00@16 50
" House "	22 00@23 00
" Orrel	17 00@18 00

Per ton 2,240 lbs., ex-ship.

PRICES FROM YARD.

Liverpool House Orrel, screened	$20 00@22 00
" Cannel, "	23 00@25 00

Per ton 2,000 lbs. delivered.

Prices of Gas Coals.

February, 1873.

PROVINCIAL.

Corrected weekly by Louis J. Belloni, Jr., 41-43 Pine st., N. Y

	Coarse.	Slack.
Block House	$2 00	$1 00
Gowrie	1 75	— 80

Corrected by Bird, Perkins & Job, 27 South street.

	Coarse.	Culm of Coal.
Pictou	nett $2 25	1 25
Sydney	2 25	— 80
Lingan	1 75	— 80
Caledonia	1 75	— 80

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty on all slack coal or Culm: 40c. per ton of 28 bushels, 80 pounds to the bushel. On all bituminous coal or shale: 75 cents per ton of 28 bushels.

AMERICAN.	Nominal quo. Currency.
Westmoreland	$7 10 @— —
Fairmount Gas Coal Co. of N. Y	7 00 @— —
Despard Coal Co	7 00 @— —
Penn	7 10 @— —
Newburg Orrel Gas	— — @— —
West Fairmount Gas Coal	7 00 @— —
Redbank Cannel, Penn	— — @— —
AT PHILADELPHIA.	
Westmoreland	7 00 @— —

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

Philadelphia and Reading Railroad, from Schuylkill Haven Lump and St., net, $1 60; Br., Egg and Ch., $1 65; Stove, $1 75	
Shipping at Pt. R., 20c., for use at Port., $2 15 from Pt. Carbon.	
MAUCH CHUNK TO ELIZABETHPORT.	
L. V. Railroad from Mauch Chunk to Phillipsburgh	$0 72
C. R. R., N. J., Phillipsburgh to Elizabethport	1 06
Shipping expenses at Elizabethport	25
Wharfage	10
Total	$2 23
MAUCH CHUNK TO PORT JOHNSTON.	
L. V. R. R., or L. & S. R. R. from M. C. to Phillipsb'g	$0 72
C. R. R., of N. J., Phillipsburgh to Pt. Johnson	1 06
Shipping expenses	25
Wharfage	10
Total	$2 23
TO HOBOKEN	
L. V. R. R., Mauch Chunk to Phillipsburgh	72
Morris & Essex R. R. Phillipsburgh to Hoboken	1 06
Shipping expenses	25
Wharfage	10
Total	$2 23
TO SOUTH AMBOY.	
L. V. R. R.	72
R. & D. R. R. / Cam. & Am. R. R.	1 06
Shipping Expenses	25
Total	$2 23
PENN HAVEN TO ELIZABETHPORT.	
L. V. & R. Penn Haven to Phillipsburgh	0 84
C. R. R. of N. J. Phillipsburgh to Elizabethport	1 06
Shipping expenses	15
Wharfage	20
Total	$2 35

Freights.—February, 1873.

TO EASTERN PORTS.	Cumberland. From Georgetown.	Cumberland. From Baltimore	Anthracite. From Philad'a.	Anthracite. From Phila. Port, Port Johnston, and Hoboken.	Anthracite. From Newburgh.	Anthracite. From Rondout.
Amesbury						
Bangor						
Bath		5 00				
Boston	3 10	4 75	3 00	3 00		
Bridgeport	2 75	3 50	1 00	1 00		
Bristol			2 00			
Cohasset Nar'ows	2 25		1 25			
Derby			ice			
Dighton	2 85		ice			
East Cambridge			3 10			
Fall River	2 75	3 50	2 00	2 00		
Hackensack			ice			
Hartford		3 25	ice			
Hoboken	2 10		50	50		
Jersey City	2 10		50	50		
Lynn			1 35			
Middletown			ice			
Mystic			ice			
New Bedford	3 00	4 00	2 00	2 00		
Newburyport	3 10	5 00	2 25	2 25		
New Haven	2 75	3 50	1 00	1 00		
New London	2 75	3 50	1 45	1 45		
Newport	2 80		3 00	2 00		
New York	2 25	3 50	50	50		
Norwalk	2 50	2 ½	1 00	1 00		
Norwich			1 65	1 65		
Pawtucket			ice	ice		
Portland	3 25	4 75	2 90	2 90		
Portsmouth, N. H		5 00	3 10	3 10		
Providence	2 75	3 50	2 00	2 00		
Rockport						
Saco						
Sag Harbor			1 45	1 45		
Salem	2 70	4 75	3 00	3 00		
Stamford			1 00	1 00		
Stonington			1 50	1 50		
Taunton			ice			
Warren			2 00	2 00		
TO RIVER PORTS						
Albany						
Catskill						
Cocksackie						
Coeyman's						
Cold Spring	2 80					
Fishkill						
Haverstraw						
Hudson	3 25					
New York						
Nyack	2 25					
Poughkeepsie	3 50					
Rhinebeck						
Rondout						
Sangerties						
Sing Sing						
Stuyvesant						
Tarrytown						
Troy	3 00					
West Point						
Yonkers						

St. Thomas	$5 00 Gold.
Martinique	5 00
Demerara	6 00
New Orleans	6 00
Mobile	6 00

Foreign and Provincial Freight

February, 1873.

Foreign.
Newcastle and Ports on Tyne, per keel of 21 1-5 tons £
Liverpool, 5 per cent primage

TO NEW YORK.

Provincial.

Sydney	$3 05
Lingan	3 50
Cow Bay	3 75
Port Caledonia	3 10
Little Glace Bay	3 00

TO BOSTON.

Sydney	3 00
Lingan	3 00
Cow Bay	3 00
Port Caledonia	3 00
Little Glace Bay	2 90

MARKET REVIEW.

NEW YORK, Feb. 6, 1873.

IRON.—The market for Scotch Pig continues very quiet. Stocks are being gradually reduced, and there is but little on the way; but in the absence of a demand for present delivery, prices are about steady. There is some inquiry for future delivery from consumers, but the prices now asked tend to restrict sales. A majority of the large consumers in this city are, we understand, running on short time, and the consumption is on that account greatly lessened; we only note a sale of 50 tons Englinton at $55. American Pig is without any decided change, the market continues firm with an upward tendency. Most of the companies have light stocks on hand, and their manufacture is principally of Forge. There is a fair inquiry for Nos. 1 and 2 X, and several hundred tons of various brands have been sold at full figures. New and Old English Rails are steady at previous quotations. Scrap is in light demand, with very little offering, the stocks here being closely concentrated and firmly held at $57,50a$60 from yard. Refined Bar continues firm at our quotations, with only a moderate business. Russia Sheet is held at 16¼ cents gold for sound.

LEAD.—Pig remains very quiet, nominal price for common Foreign 6¼a6½ cents gold; 50 tons Domestic sold at 6½ cents gold. Manufactured continues steady at old figures.

COPPER.—New Sheathing is steady at 43 cents, and Bolts and Braziers 45. Bronze and Yellow Metal Sheathing 27, and Y. M. Bolts 32, net cash. For ingot there is more inquiry, and, though the actual is not large, there is evidently a better feeling accompanied with some little advance in prices; we note sales of 250 000 lb. Lake at 34 up to 34¼ cents cash, and 35 for March delivery; and 50 tons B. S. English, 30¼ cents on the spot and 30 to arrive 30 days.

SPELTER—There has been a considerable movement at full prices; the sales are 75 tons Silesian at $7,15a7.25, and 275 do. part to arrive, at $7a7,25, all gold. The market tends upward.

TIN—Pig remains inactive, and prices are in a great measure nominal. Straits is held at 30½a31 cents, English 31, and Banca 36¼ gold; 200 slabs Straits sold in Boston at 30 cents. The foreign markets are all relatively higher than this, but buyers hold aloof. Plates are dull, and, though stocks are light, prices are barely sustained; we note sales of 1000 bxs. Charcoal Tin at $11a11,12½; and 800 do. Charcoal Terne, $10.12½ gold.

ZINC—Mosselmann Sheet is quiet but firm at full former prices—from store dealers ask 9 cents gold, net.

Edward Samuel under dated of Philadelphia, February 3, 1873, says:

There is but little change to note in prices the past week. The market abroad remains firm. Manufactured Iron is without change.

Below are the highest and lowest quotations for different makes.

American No. 1, foundry, at Furnace, $48a49; No. 2, $44a45; No. 3, Forge, $38a40; No. 4, White and Mottled, $32a34; Scotch Pig, Cargo Lots, for shipment, $49a50; Old Rails, DHs, for shipment here, $50a51, gold; do. on on the spot and for arrival, $49a50; No. 1, Wrought Scrap, ex ship, $49a50; do. for shipment here from abroad $48a $50; American Refined Bar, Mill price, 4½ cents, Common $37,50a90; Rails, at Mill, $32a34; English Rails, ex ship, N. Y., $72½a74, gold.

We extract the following review of the coal exports from the United Kingdom, for 1872, from the *Colliery Guardian* of Jan. 10, 1873:

We have now obtained more definite information in respect to the extent of the coal exports made from the United Kingdom in 1872. The official figures which have been compiled upon the question are subject to revision and correction, but they are sufficiently complete and precise for our present purpose. Thus, we appear to have sent abroad last year coal, coke, cinders, and patent fuel to the extent of 13,211, 941 tons. This total compares as follows with the corresponding exports of the previous fifteen years:—

Year.	Tons.	Year.	Tons.
1857	6,787,718	1865	9,170,477
1858	6,529,483	1866	6,953,712
1859	7,006,949	1867	10.415,778
1860	7,321,832	1868	10,837.804
1861	7,855,115	1869	10,588,425
1862	8,301,852	1880	11,702.619
1863	8,275 212	1871	12,747,989
1864	8,809,908	1872	13,211,961

The progress made by our coal exports last year was less rapid than in 1871, but it is remarkable that there should have been any progress at all, having regard to the extraordinary advance which prices experienced during the latter half of last year. The most extraordinary feature, indeed, of the statistics available with reference to our coal exports is the increasing magnitude of the sums which those exports have represented of late. Thus, the value of the coal, coke, cinders, and patent fuel exported during the last sixteen years has been as follows:—

Year.	value.	Year.	Value.
1857	£3,210,661	1865	£4,427.177
1858	3,045.434	1866	5,102,805
1859	3,270,013	1867	5,392,452
1860	3,316,281	1868	5,352.525
1861	3,604,790	1869	5,067,790
1862	3,750,867	1870	5,638,371
1863	3,713,798	1871	6,246,133
1864	4,165,773	1872	10,443,920

It will be seen that, while the exports have about doubled in respect of quantity during the last fifteen years, the value represented by them has multiplied more than three-fold. Nevertheless, there can be little doubt that the extremely high price which coal has now attained exercised a depressing effect upon our coal exports last year. We more than held our own last year upon the Swedish, the French, the Spanish, and the Italian markets; but we lost ground in Russia, Denmark, Germany, Holland, Brazil, and India. France has once more become our largest coal consumer, having taken last year 2,191,340 tons, against 2,006,152 tons in 1871, and 2,106,784 tons in 1870. Germany figured last year as a consumer of English coal to the extent of 2,112,128 tons, against 2,396,811 tons in 1871, and 1,603,749 tons in 1870. Germany would thus appear to have imparted to her coal-mining industry last year a large measure of the vigor which it lost during the Franco-German war. France, on the contrary, became more dependent upon us for coal than ever. France has from time to time made efforts to diminish her consumption of English coal, and to develop her own coal production. These efforts have not been altogether unsuccessful, but, at the same time, the demand for coal in France has grown much faster than the native extraction, and the consequence is that we are continually parting with more and more of our coal in exchange for our neighbors' francs. In 1822, we sent 31,105 tons of coal to France; in 1832, 37,530 tons; in 1842, 490,738 tons; in 1852, 652,390 tons; in 1862, 1,306,255 tons; and last year, as has been already stated, the total expanded to 2,191,340 tons. Between 1862 and 1852, the increase in the French consumption of English coal was 653,865 tons; between 1872 and 1862, the corresponding increase was 885,085 tons. Instead, therefore, of the French demand for English coal slackening, it is increasing in even an accelerated ratio. The same may be said of the foreign demand for our coal, generally, since, between 1867 and 1862 the increase in the exports was 2,113,926 tons, while between 1872 and 1867 the corresponding increase was 2,196,183 tons.

Notwithstanding the very many improvements which have been brought to bear upon coal working and coal mining throughout the world, and the success which has attended the efforts made in these respects, the accelerated progress of our own coal exports is truly remarkable, albeit that it is not at all clear that a continually increasing external demand for our coal is a legitimate ground for national congratulation and self-complacency. Even assuming that the ratio of increase is not carried to a higher point than at present, we shall export in 1877 no less than 16,690,401 tons of coal and coke. No doubt, the production will increase in the interim in these islands, but still the continual and rapid increase in the foreign and colonial demand for our combustibles is not a matter to be overlooked. British India has been dreaming and moving in the matter of the utilization of her native coal; nevertheless, she had to pay £504,026 last year for coal imported from the parent land, to say nothing of the crushing accessory charge for freight. In France, again, last year, the payments made for English coal amounted to no less than £1,501,769. The fact is, that steam power has given a great impetus to manufacturing industry in all its varied forms, and in that manufacturing industry both capital and labor find, as a rule, such profitable employment that insufficient efforts are put forth to render more readily and cheaply available the source from which the great modern magician derives his marvellous strength.

San Francisco Stock Market.

BY TELEGRAPH.

NEW YORK, Feb. 6, 1873.

The following from the San Francisco Stock Board is dated the 4th inst.

		Feb. 4.	Jan. 28.
Savage	—	61	51
Crown Point	—	102	85
Yellow Jacket	—	76	62
Kentuck, "New Issue"	—	12	7
Choller Potosi	—	58	46
Gould & Curry "New Issue"	—	15	12
Belcher "New Issue"	—	83	70
Imperial	—	7¼	6
Raymond & Ely	—	91	81
Meadow Valley	—	16½	16

MISCELLANEOUS.

BANKING-OFFICE OF FISK & HATCH.

No. 5 Nassau st., New York, Jan. 28, 1873.

The CHESAPEAKE and OHIO, the CENTRAL and WESTERN PACIFIC BONDS, all of which have been negotiated by us, we believe to be among the best and most desirable Investment Securities in the market, which in time must become very scarce, especially as the Government will probably, during the year, pay off, in gold, another large lot of FIVE-TWENTIES, and issue in their place FIVE PER CENT. BONDS.

The CHESAPEAKE and OHIO SIX PER CENT. GOLD BONDS, the total amount of which is only $15,000,000, are secured upon a property worth $35,000,000 to $40,000, 000, and are fully equal in intrinsic value to the CENTRAL PACIFIC BONDS. They are issued in denominations of $100, $500, and $1000, Coupon or Registered, and at their present market price (86 and accrued interest), are very desirable.

The CENTRAL PACIFIC SIX PER CENT. GOLD BONDS are too well known to require description or commendation. Their total amount is $25,885,000; they have for a long time ranged in market price near or above par.

The WESTERN PACIFIC SIX PER CENT. GOLD BONDS amount to $2,735,000. This road is now consolidated with the CENTRAL PACIFIC, and the payment of its bonds, principal and interest, is assumed by them. Their market price to-day is 90¼ to 91. As they have recently been introduced on the Stock Exchange, we expect to see them rapidly rise to the price of CENTRAL PACIFICS, being substantially the same in character and value.

We buy and sell, as usual, Government Bonds, receive deposits, on which we allow interest; make collections, and conduct a general banking business in all its branches.

Feb. 4.tf FISK & HATCH.

R. P. ROTHWELL,

MINING AND CIVIL ENGINEER

ROOMS 90, 91,

71 Broadway, N. Y., and Wilkesbarre, Pa.

Reports on the value of mineral property—advises on the working and management of mines—makes detailed plans and estimates for mining improvements and appraisements of the value of mines, mining machinery &c., and gives information as to the value of mining stocks &c., as investments.

P. O. Box 2487, N.Y.

ALX. TRIPPEL, C.E., MINING ENGINEER AND METALLURGIST.

ISIDOR WALZ, Ph.D. ANALYTICAL AND CONSULTING CHEMIST.

No. 18 EXCHANGE PLACE, NEW YORK.

B. B. FRENCH, C. E.,

BRIDGES,

IN IRON, WOOD, OR STONE.

DRAWINGS, ESTIMATES, &c.

155 Broadway, New York.

Dec. 31-3m

GEO. C. BATES,

United States District Attorney of Utah,

COUNSELLOR-AT-LAW.

Especial attention given to Purchase and Sale of Mines; a Examination of Title and Certificates thereto.

Jan. 7.2mo No. 97 Kimball Block, SALT LAKE CITY

EDWARD SAMUEL,

Iron Broker and Commission Merchant,

332 WALNUT STREET, PHILADELPHIA.

Solicits consignments and orders to purchase or sell American or Foreign Raw or Manufactured Irons.

Dec. 31:tf

THE UNDERSIGNED, HAVING BUT RECENTLY returned from Mexico, where he was engaged for several years in Smelting and Amalgamating Silver Ores, especially the Base Metals, is now open for an engagement.

Feb. 4.3t A. W. GENT, Boston, Mass.

The Rand and Waring Air Compressor.

(SEE SUPPLEMENT.)

The great obstacles to the more general use of compressed air as a motor, or vehicle for the transmission of power, have been the great losses incurred through the friction of the additional machinery, and through the heat generated by the compression; the last has hitherto been much the most important source of these losses.

In a paper from the hand of Prof. G. W. MACQUORNE RANKINE, which was read before the Institute of Engineers of Scotland, on the night of the death of Prof. RANKINE, the following paragraph appears, as reported in *London Engineering:*

"In transmitting power by compressed air, there were great and unavoidable losses of power in the air-compressing engine, arising mainly from the waste of heat developed by the compression of air. The losses seldom amounted to less than 65 to 75 per cent. of the whole power of the compressing engine, and it could be shown that in extreme cases they might even exceed 90 per cent."

In the discussion called out by the reading of the paper, the following remark was made by one of the members:

"The loss of 65 to 75 per cent. which occurs in air-compressing engines, exceeds many times the loss theoretically due to waste of heat, and we may therefore expect to see it greatly diminished through the gradual improvement of machinery."

The truth of this remark will be readily recognized by any one who has made the laws of thermodynamics a special study; for if the compressing vessel could be made of a *perfectly conducting* material, the heat would flow out as fast as generated, and no additional resistance would be caused by it; and though this ideal condition can never be absolutely realized in practice, yet the conducting power of metals allows an approach to it sufficiently near to give very valuable economical results, where the machinery is so arranged as to carry off the heat from the compressing vessels as fast as it is absorbed by the metal of the enclosing cylinder. The excessive heat must be absorbed during the process of compression, and before the air leaves the compressing cylinder; otherwise, its resistance will have to be overcome in the compressor by mechanical power, and then its force will escape by conduction *in the transmission*, and thus be not only useless as a source of additional power, but, in the case of subterranean works, incidentally detrimental to the underground ventilation. If a volume of air of 60° could be compressed five volumes into one, in a perfectly non-conducting vessel, the temperature reached would be about 544°, and the increased resistance would be about 93 per cent. more than that which is due to five atmospheres, or equal to about 9.64 atmospheres; but if it were compressed in a vessel capable of absorbing the heat nearly as fast as generated, only a small portion of this resistance would be encountered.

The compressor, described in this article, is so constructed as to remove the excessive heat, by providing for its absorption and conduction through all enclosing surfaces, which surfaces are kept cool by a free circulation of water behind them.

Ample experiment has proved that it is capable of absorbing all objectionable heat with sufficient rapidity to allow any desirable speed in the movement of the compressing piston, the heat being carried away by a flowing current of water surrounding the compressing vessels, but out of contact with the air itself. A piston of twelve inches diameter, compressing to four atmospheres, has been moved for several consecutive hours, at the rate of more than four hundred and fifty feet per minute, producing only a very slight and altogether unobjectionable warming of the machinery.

The compressing cylinder is composed of three concentric shells, which form two annular spaces around the working cylinder; the outer space affords a passage for the air after compression, and also a vessel for collecting any moisture that there may be in the air; the inner space forms passages for the water used in cooling. The outer double cylinder is cast in one piece; the inner one, in which the piston works is cast and turned separately, and fitted to bearings in the outer. It is merely a thin metallic lining, resting upon bearings which are continuous throughout the whole length at top and bottom, but are placed at intervals on the sides; these continuous bearings divide the adjacent annular spaces into two parts, for the purpose of making the circulation of water more complete.

The heads of the cylinder are also hollow, for the reception of the cooling water and to afford passages for air.

The piston and piston-rod are also hollow, with passages to permit the flow of water through them. The piston-rod passes through both heads of the cylinder, and the part which extends beyond the outer end is enclosed in a water-tight casing, a tube somewhat smaller than the bore of the piston-rod is fixed at the extreme end of the casing, and extends in the bore of the piston-rod through the entire length of the cylinder; this affords water passages through the piston and piston-rod.

A gland or diaphragm, preferably of some slightly elastic substance, is fixed in the bore of the piston-rod, near the centre of the piston. This gland is fitted to and slides over the tube, during the movement of the engine, and compels the flowing water to pass, through suitable pipes, into, around and out of the piston, into the bore of the rod beyond; the tube takes the water back out of the machine after it has passed the whole length of the piston-rod.

A minor difficulty in the use of compressed air as a motor, though one, which in some cases has assumed considerable importance, is the clogging of pipes and passages, and particularly the exhaust ports by ice; this is formed from the precipitation of the moisture of the air as the result of cooling. The capacity of the air for holding moisture decreases with any reduction of temperature. If the air at a high temperature is saturated with water, and then allowed to cool, it will release and precipitate a part of the water which it held in suspension at the higher temperature.

When air has been compressed, and the heat generated by compression taken away, any expansion or reduction of pressure cools the air to below the freezing point, and ice attaches to the enclosing vessels.

The systems of compression generally used in Europe overcharge the air with moisture, by exposing it, during compression, to direct contact with the water, either by the use of the oscillating water column or of a spray injected through the compressed air. In some of the English coal mines, great expense has been incurred to overcome this difficulty.

In one instance, at least, the operation of the machinery devised for cooling, by the introduction of water into the cylinder, has been entirely suspended during the winter, in consequence of the difficulty encountered by the production of ice.

It is the belief of the proprietors of the Rand & Waring Compressor that the system of dry compression, which is applied in that machine, will place this difficulty under better control than any other yet devised.

The parts of the machine devoted to cooling are such as to give perfect control of the supply of water, the amount of which, under all ordinary circumstances, has been determined by calculations verified by experiment. Means are provided for regulating the supply to suit any difference of compression, climate or temperature of the outer air. The water may be introduced into the cylinder by a pump either attached or independent, or it may be supplied through a simple pipe, from a head affording suitable pressure. It enters the extreme end of the cylinder and passes along the annular space through the whole length, to the head at the opposite end, thence, passing around the valve chambers and piston rod, it enters the opposite side of the annular space around the cylinder, and returning the whole length of the cylinder, passes into the hollow head near which it first entered the machine. From this head, it enters the casing beyond the extreme end of the cylinder, above mentioned, which casing contains the prolonged piston rod and small tube, thence it passes into the bore of the piston rod and flows forward to the gland at the piston. This gland cuts off the direct passage of the water outside of the tube, and forces it through suitable pipes on opposite sides of the gland, into, around and out of the piston, whence it continues its course along the bore of the rod beyond to the open end of the tube, and entering there, passes back through the tube out of the machine.

This system of circulation places a current of flowing water behind every part of the compressing machinery with which the air comes in contact during compression, while cold water is continually supplied as fast as it is required.

The air valves are of the class usually called bonnet or conical valves. They are operated both ways, principally by air pressure produced by the action of the machine, but are held to place by slight spiral springs. The inlet or induction valves open directly from the external air to the interior of the compressing cylinder, through casings which pass through both shells of the cylinder head. They are mounted in movable housings, for facility of repair. The outlet or delivery valves are hollow cases, which can readily be drawn out by removing a cap. Their automatic action is perfectly simple: as the piston moves away from either head of the compressing cylinder, the inlet-valves open and admit the outer air to fill the space swept through; as soon as the end of the stroke is reached, the pressure on both sides being equalized, the valves are closed by the light spiral springs; as the piston returns, it compresses the air which has been drawn into the cylinder, until its density somewhat exceeds that of the receiving tank or reservoir, when the outlet-valves open and the compressed volume is forced through them, the valves closing by the action of the springs when the end of the stroke is reached.

The lubrication of the working cylinder by water is effected through a space in the piston between the two sets of packing rings, communicating with the water in the hollow chamber, which is forced outward by the pressure, which causes the circulation. This wets the whole interior periphery of the cylinder with a thin film of water as the piston moves through it.

A very simple attachment has been made, by which all the water may be driven out of the machine in a few moment's time, to prevent freezing when not in use, or for any other purpose. This is done by simply shutting off the water cock and turning on the compressed air into the water passages. The application of the steam power through an inclined steam cylinder forms an important feature of this machine. The object is to apply the greatest effort of the steam at the instant of the greatest resistance of the air. In a direct-acting compressing pump—that is, one in which the steam and air pistons work on the same line—there is very great inequality between the power and the resistance at corresponding points in the stroke, particularly if any expansion is used. In such a machine this can only be overcome by the use of fly-wheels disproportionately large; but by the use of the inclined steam cylinder this enemy is turned into an ally, the economy of expansion is secured to any desirable extent, and the machine is much simplified.

In case the steam is cut off at four-tenths, and its maximum pressure is two-

CONTINUED ON PAGE 91.

THE ENGINEERING AND MINING JOURNAL.

ROSSITER W. RAYMOND, Ph. D.,
JOHN A. CHURCH, E. M.
Editors.

PUBLISHERS' ANNOUNCEMENT.

THE ENGINEERING AND MINING JOURNAL *is projected in the intent of furthering the best interests of the Engineering and Mining public, by giving wide circulation to original special contributions from the pens of the ablest men in the professions. The careful illustration of new machinery and engineering structures, together with a summary of mining news and market reports, will form a prominent feature of the publication.* It is the Organ of the American Institute of Mining Engineers, and is regularly received and read *by all the members and associates* of that large and powerful society, *the only one of the kind in this country.* It is therefore the best medium for advertising all kinds of machinery, tools and materials used by engineers or their employees.

SUBSCRIPTION—$4 *per annum in advance;* $2 50 *for six Months.*

ADVERTISEMENTS—*The rates are as follows: Inside pages, 25 cents per line each insertion; the outside or last page, 40 cents per line. Payment required in advance.*

NEWSDEALERS *will be supplied through the agency of the* AMERICAN NEWS COMPANY, *No.* 121 *Nassau street, New York City.*

COMMUNICATIONS *of all kinds should be addressed to the Secretary. The safest method of transmitting money is by checks or Post-office orders, made payable to the order of* WILLIAM VENTZ, *Correspondence and general communications of a character suited to the objects of* THE ENGINEERING AND MINING JOURNAL *will always be welcome.*

The Postage on THE ENGINEERING AND MINING JOURNAL *is twenty cents a year, payable quarterly in advance, at the office where received.*

THE SCIENTIFIC PUBLISHING COMPANY,
WILLIAM VENTZ, SECRETARY.
27 Park Place,
P. O. Box 440 NEW YORK CITY.

CONTENTS FOR THIS WEEK.

The Life of Iron Rails	81	EDITORIALS:	
The Illinois Patent Coke Works at East St. Louis	82	Peter Von Rittinger	89
The Telegraph in a Storm	83	The Gunpowder Problem	89
Notes on a Metallurgical Journey in Europe	83	The Analyses of American Iron Ores	90
THE COAL TRADE	85	American Society of Civil Engineers	90
THE MARKET REVIEW	87	MINING SUMMARY:	
San Francisco Stock Market	87	Colorado	91
Advertisements	87	Utah	92
The Rand and Waring Air Compressor	88	The American Institute of Mining Engineers	92
		Advertisements	92

WE learn from private sources that the last run made in the Auburn Mill at Reno, Nev., prior to shutting down, was the most successful ever made. Forty tons of ore were chloridized in the Stetefeldt Furnace to an *average* of 94.5 per cent. silver. The highest assay was 96.5 per cent., the lowest 90 per cent. (this last was the first assay). The ore consisted of twenty tons rich ore, with quartzose gangue, containing about 10 per cent. lead, from Inyo County, Cal.; and a like amount of ore, holding some lime and about 8 per cent. lead, from Salt Lake. The first lot contained $500 to $600, and the last $60 to $90 silver. Five tons of each lot were roasted separately, the rest mixed together. The assays were reliable ones, made for mill purposes and not for show.

WE MENTIONED, a fortnight ago, that the clause in the new mint bill, providing for the redemption of abraded coins at par, was struck out by the Senate. The reasons for rejecting the provision are simple and conclusive. It opens the door to certain tampering with coins on the part of "sweaters." The true policy is to provide that wherever any gold coin of the United States is reduced by abrasion or otherwise, below the standard weight and tolerance of single pieces, such gold coin shall be a legal tender at a value proportioned to its weight; and it shall be the duty of every officer of the United States to deface such coin when tendered to him in payment, if reduced one per cent. below such standard weight—and when received by him, to transmit the same to the mint, where it shall be recoined without charge.

THE January number of the *Mining Review*, published monthly at Georgetown, Colorado, by Messrs. T. J. CAMPBELL, C. A. HOYT, and T. F. VAN WAGENEN, contains much valuable information concerning the mining operations of 1872 in that Territory, including abstracts of the reports of some of the Territorial Assayers. The *Review* has been sent to us very irregularly—mostly not at all; and this is the reason of our failure to notice it, and to credit specifically to it a statement of Judge BELFORD's decision in the Hercules case, which we found in another paper, but which the *Review* now claims. As it complains that we called it merely "a Colorado Journal," when we did not know any better, we venture to complain ourselves that in the same paragraph, the *Review* calls us merely "an Eastern mining contemporary," when it does know better. However, we do not feel very much hurt by such trifles; nor will the *Review*, when it is a little older.

The announcements of the Local Committee for the Boston meeting of the American Institute of Mining Engineers will be found in the Bulletin, on another page. We trust that the present indications of a large attendance and a pleasant and profitable meeting will be amply fulfilled. In answer to some inquiries addressed to us, we publish the following communication:

NEW YORK, Feb. 6, 1873.

My attention was called, a few days ago, to reports in the public press, concerning the recent prevalence of small-pox in Boston; and I communicated at once to the gentlemen of the Local Committee my desire for a careful inquiry as to the present state of the case, assuring them that if the circumstances even seemed to warrant any apprehension, I would not hesitate to assume the responsibility of countermanding the meeting, even at the last moment and without a regular vote of the Council. The statements of Professor HUNT and Professor PETTEE, made without consultation, as the result of independent inquiry, agree with each other and with my own opinion, that there is not the slightest occasion for such a course. The small-pox has been conquered in Boston; the temporary prevalence of it, due to the relaxation of sanitary precautions after the great fire, has yielded to the energetic measures of the present authorities; and it is without any unpleasant doubt or spirit of opinionated obstinacy that I assure the members and associates of the American Institute of Mining Engineers that the arrangements for the meeting need not be, and will not be, interrupted.

R. W. RAYMOND, President.

Peter Von Rittinger.

It is with deep regret that we learn from Vienna papers the death of PETER VON RITTINGER, the distinguished Austrian mining engineer, which took place on the 7th December.

VON RITTINGER was born in 1811, at Neu Titschein, a village of Moravia, of very poor parents, who died while he was still quite young. He was then taken care of by rich strangers, who attended to his early education. He was distinguished at the public school for his precociousness and assiduity, by virtue of which he was enabled to obtain means to go to the Gymnasium at Leipnik, and from there to attend the University at Olmütz. While at the latter institution, he developed an especial predilection for mathematics and physics. After leaving the University, he went to the Mining School at Schemnitz, and on graduating there, in 1839, was appointed instructor of Higher Mathematics and Perspective. In 1840 he was appointed Stamp-Mill Inspector at Schemnitz, which office he continued to hold until 1848, when he was sent to Bohemia to direct the Government operations in searching for coal. RITTINGER was appointed director of the Mining Office at Joachimsthal, Bohemia, in 1849, where he remained until the following year, when he was called to Vienna as Section-Councillor of Mining, which position he retained until 1868, when he was promoted to be Ministerial-Councillor. He was generally considered the leading authority on the Concentration of Ores, in which branch of Mining he made numerous new inventions and improvements—amongst others the Continuous Percussion-Table which bears his name. In 1867 he published a work on the Concentration of Ores, called "Lehrbuch der Aufbereitungskunde," which, together with his Reports on the Paris Expositions of 1855 and 1867, and that at London 1862, as well as his annual "Erfahrungen im Aufbereitungs-Kunst- und Baufache," 1850–1871, formed his chief works. His death leaves a gap which it will be almost impossible to fill.

F. P.

The Gunpowder Problem.

It has long been known that the chief difficulty to be overcome in the construction of large cannon results from the fact that the destructive effect of gunpowder increases, when we enlarge the calibre, much more rapidly than the restraining power of the gun. An enlargement of the calibre implies an addition to the weight of the projectiles and of the charges of powder; and not only is the total effect increased, but also its relative intensity; that is to say, not only is the number of square inches increased upon which the expanding gases act, but the intensity of the pressure per square inch is also augmented. When the necessity for larger guns became imperative, European constructors supplanted cast iron with wrought iron and steel, and thus succeeded in increasing the strength of their guns to the required degree. But when the progress of naval construction called for still greater ballistic power, even this resource began to show signs of inadequacy. In the meantime, the same problem had to be solved by American constructors, who approached it in a different manner. As this country possessed no workshops or machinery adequate to the forging of very large cannon, instead of endeavoring to build guns which powder could not destroy, our officers endeavored to obtain a powder which would give the necessary velocity to the projectiles without destroying the gun. This course was first marked out by RODMAN, when he built his famous 15-inch gun. Foreseeing that unless he could maintain the velocity of the projectiles, the increased size would be of insufficient advantage to compensate its inconveniences, he applied himself to the study of the action of gunpowder. His first result was the establishment of "mammoth" or large-grained powder for the service of large guns. He demonstrated that by this device the velocity of large projectiles could be maintained with a great reduction in the destructive effects of the powder. This identical device has, within the last three years, been adopted by the English for all their large guns, under the name of "pebble powder." Although this powder was introduced into our service prior to 1860, the English appear to regard it as an innovation originating in their own country. The value of priority in the matter is, however, much diminished by the fact that the effect of varying the size of the grain has been known, in a general way, in all countries, for many years, and perhaps for centuries; and the mammoth powder is merely an extreme case in the application of an old principle. But the first accurate and available determinations and measurements of these effects are due entirely to RODMAN.

This distinguished officer made a number of brilliant inventions, in which he

displayed the rare and double merit of elucidating principles and originating ingenious devices for making them available. A striking illustration of this is his invention of perforated powder, which was made by pressing the materials, in a moist and adhesive condition, into the form of hexagonal prisms, with perforations parallel to the axis. While experiments were progressing with this powder, an eminent Russian officer, Major (now Major-General) GADOLIN, being in this country, and taking much interest in the subject, recommended its trial in Russia, and the result was its adoption, first, by the Russian, and afterwards by the Prussian government, in whose heavy guns it is now used exclusively. The principle involved may be briefly stated. While the shot is moving from its seat to the muzzle, and acquiring its velocity, the force of the powder is undergoing great and rapid changes of intensity. This intensity is known to reach its maximum, with ordinary powders, before the shot has moved a foot from its original seat. The pressure then falls off rapidly as the shot moves towards the muzzle. It is these earlier pressures which are so dangerous, while the later ones are far within the limit of pressure which the gun is capable of enduring with safety.

Now, if it were practicable to manage the powder in such a manner that the earlier pressures would be reduced, and the later ones increased, the total force would be the same, while the dangerous pressure would be avoided. RODMAN sought to attain this action by the following means. It is clear that the pressure at any moment has a direct relation to the quantity of gas developed by the powder in its progressive combustion; and again the quantity of gas developed at any moment has a direct relation to the quantity of powder surface undergoing combustion at any moment. Hence, if the surface of a given weight of powder be small, the quantity of gas at first developed, and the consequent early pressure will also be small. If the powder, in other words, can be made to burn less rapidly at first, and more rapidly afterwards, the desired end may be reached. Since large-grained powder presents less original surface than an equal weight of small grain, this object is in some degree approached by mammoth powder. A further approximation is obtained by the prismatic form; for the large, symmetrical grains present, at first, a comparatively small surface, while the perforations are constantly increasing their diameters and surfaces, as the grain is consumed.

Recent experiments with the thirty-five ton Woolwich gun have shown, that even mammoth powder is too violent for guns of this size. This conclusion was reached in this country several years ago, after the bursting of several large rifles firing this grade of powder. Within the last two years the Ordnance Bureaux both of the Army and Navy have recognized, that it is indispensable to further progress to gain a more thorough control over the energy of gunpowder than has been yet reached by other nations, and with this view have applied themselves vigorously to the problem. The results thus far attained have not been made public, but are said by those who know, to be peculiarly gratifying.

The navy bureau is experimenting upon powder for the fifteen inch gun, while the army bureau is firing heavy rifles, and both have succeeded in obtaining high velocities with unprecentedly low pressures. We understand that some new and important features have been introduced, but we are not informed as to their character. The experimental powder has been manufactured by Messrs. DUPONT & Co., of Wilmington, who are entitled to the highest credit for their intelligence and zeal, as well as for the excellence of their products. The important nature of these investigations may be inferred from the remark recently made to us by a distinguished officer engaged in them, who said that if the results continue to be what they have been, we shall be able to obtain, with perfect safety, from cast-iron guns of the largest calibre, higher velocities than have ever yet been reached with similar calibres elsewhere. During the coming year, these experiments will be diligently prosecuted.

The Analysis of American Iron Ores.

An address to the Chairman of the Executive Committee of the Centennial Commission has been published, and is now distributing for signatures, the purpose of which is to secure the appointment of a Commissioner of Iron Ores, whose duty it shall be to see that characteristic specimens are obtained from all American mines and analyzed. The circular truly says that the time remaining for the work is only too short. Two experts, with assistants, spent between two and three years in analysing 160 specimens of British ores exposed in the London Exhibition of 1851. The progress of chemical knowledge will enable the work to be done faster now, but on the other hand, there will be many more specimens to analyse.

The collection and analysis of American ores is a work which we heartily commend, and one which, so far as we can judge of the feeling among iron miners and iron smelters, will meet with their approval. It was well said in a meeting of the Mining Engineers' Institute that the work of past analysts is almost useless to us. They sought to elucidate the questions of their day, and were content with analyses which went no further than this. New questions come up, and we turn to their work for confirmation or denial, only to find that the new points can receive no light from the old analyses. Nowadays, the chemist must work both for the present and the future. Thoroughness must be his main care. Methods of analysis, too, have changed in the constant criticism of years, and the old work must frequently be looked upon with suspicion. Read Mr. RILEY's suggestive paper on the manufacture of iron and steel, published in this journal in the numbers from October 1 to November 26, 1872, and it will be found that that [paper is not] only a dictionary of the analyses most interesting to iron workers, but it is filled with what we may call scientific suspicions, engendered by years spent in comparing the results of analytic and of practical work.

There are but few chemists in the world whose private labors have furnished them with such store of materials, useful to the iron master, as Mr. RILEY possesses. But the occasion of the Centennial celebration affords Americans an opportunity of making a collection of iron analyses, such as was never dreamed of before. If the movement proposed in this circular is carried out, there will be ready, by the Fourth of July, 1876, a book of analyses which, if proper thoroughness is used, will be necessary to every one who pretends to write or think on iron working, for scores of years to come. In fact, there was never yet presented such an opportunity for making a reference book of iron and ore analyses, nor of instituting such complete comparisons between the methods of chemical work.

We believe a number of the leaders in the iron business have expressed their concurrence with the plan proposed in the circular—such as Mr. REEVES, of the Phœnix works; Mr. PARKE, of Pittsburgh; COOPER, HEWITT & Co., of New York; T. B. BROOKS, of the Michigan Geological Survey; and with such leadership, there is good reason to expect success.

American Society of Civil Engineers.

A regular meeting of this society was held at its rooms in New York, January 8th. A paper by Mr. CHARLES B. RICHARDS, M. E., of Hartford, Conn., recording "Experiments on the Resistance of Stones to Crushing," was read.

The specimens tested were old and dry samples, well selected, of various American building stones, worked into 1 in. and 1½ in. cubes, with flat and smooth faces.

The testing machine used was built after a long experience with two smaller and similar machines. It is arranged to weigh the strains upon a sensitive platform scale of 50 tons capacity, and is well adapted to quickly give accurate results.

The specimens were crushed between the plane faces of two hardened steel hemispheres, the curved portions of which were seated in corresponding cavities of steel blocks, fixed in the machine. Single thicknesses of "lace" leather were interposed between the stones and metal surfaces, thus the pressure was uniformly distributed; it was in all cases applied to the faces of the cubes parallel to the natural bed of the stone, and carefully increased to rupture by pouring shot into the hollow weight by which the strain was caused.

Tables were presented, giving the minimum, mean, and maximum resistance to crushing per square inch of the specimens tested.

Sixteen specimens of granite, from six quarries, gave from 8,620 to 15,622 pounds minimum, 9,838 to 18,778 pounds maximum strength; 14 specimens of sandstone, from three quarries, gave from 5,806 pounds minimum, and 8,956 to 10,928 pounds maximum strength; and ten specimens of *white marble*, from three quarries, gave from 3,905 to 12,917 minimum, and 5,976 and 13,972 pounds maximum strength; each being 1 in. cubes.

The specimens failed by breaking up into slender prisms and pyramids with axes normal to the pressure.

A brief paper by F. COLLINGWOOD, C. E., of New York, upon "Rock Drilling," was also read.

In it was stated that a percussive steam drill, with 3 in. cylinder and 6 in. stroke, making 300 to 375 strokes per minute, would drill in the coarse gneiss rock, common on New York Island, 1⅛ in. holes, 3 in.; 1⅛ in. holes, 4½ in.; and 1 in. holes, 5 in. per minute.

JOSEPH P. DAVIS, C. E., of Boston, Mass., compared the late Chicago and Boston fires, and suggested a question for discussion, and one on which information is much needed, namely—Fires and their management; the best appliances and methods for putting them out.

Upon motion of Mr. F. N. FORNEY, M. E., of New York, a committee, consisting of Messrs. ASHBEL WELCH, of Lambertville, N. J., JOHN GRIFFIN, of Phœnixville, Pa., MAX. HJORTZBERG, of Chicago, Ill., and two others to be named by the Chairman, were appointed to make an investigation by means of a circular sent to each member of the society, and by such other methods as the committee may choose to adopt, to determine the following points:

1. The best form for standard rail sections for the railroads of this country.
2. The proportion which the weight of rails should bear to the maximum loads carried on a single pair of wheels of locomotives or cars.
3. The best method of manufacturing and testing rails.
4. The endurance, or as it is called, the "life" of rails.
5. The causes of the breaking of rails while in use, and the most effective way of preventing it.

The committee to report the results of their investigations at the next annual convention of the society.

A RESCRIPT has been issued by the Austrian Government, which directs that packages for the Exhibition shall not be opened at the frontier custom-houses. A detailed invoice must be sent with each package, and unexplained discrepancies between this list and the contents will make the goods liable to seizure. Goods will not be allowed to leave the Exhibition building without a permit. Goods returning home will be sent to the frontier custom-houses under the supervision of Austrian officials. Tobacco, and articles made of it, will not be allowed to leave the building for the purpose of sale, nor can they be sold within it.

The Rand and Waring Air Compressor.

CONTINUED FROM PAGE 88.

thirds that of the condensed air, the greatest excess of resistance over the effort at any point of the stroke is only about one-tenth of the maximum air pressure, and this only for a very short portion of the stroke.

Figure 1 (see Supplement) is a card on which is delineated the theoretical pressure of the steam and air at each tenth of the stroke in a machine of the direct-acting sort, or one in which the air and steam cylinders reach similar positions in equal times; the dotted lines representing the steam, and the continuous lines the air. The maximum steam pressure being forty pounds, cut off at four-tenths, the air being compressed five volumes into one, or 60 pounds to the square inch. The vertical lines indicate each tenth of a stroke, the horizontal lines showing the number of pounds per square inch, expressed by figures adjacent to each of them. At eight-tenths of the stroke, the air having reached the required density, is supposed to open the outlet valves and thence to the end the pressure is constant. It will be seen that the steam power is enormously excessive at the beginning, and very deficient towards the end of the stroke, though the aggregate power is to the aggregate resistance about as 31 to 24. It should be stated here, that in both these cards the steam and air are treated as isothermal gases, no allowance being made for the loss of heat by expansion of steam, or its increase by compression of the air. The latter would be an important item, but it is not necessary to consider it for the purposes of this illustration.

Figure 1 also shows that during the last four-tenths of the stroke the power is greatly less than the resistance, and during the last two-tenths it is less than one-third of the resistance. Every mechanic will perceive that this excessive resistance in so large a part of the stroke could not be overcome in a machine working at any practical speed without fly-wheels of enormous proportions.

Figure 2 (see Supplement) shows the effect of so inclining the steam cylinder that its greatest effort will be given at the instant of the greatest resistance of the air. All conditions of the steam and air are supposed to be the same as in Figure 1. It represents both the forward and backward stroke.

The diagram is not simply a pressure card, but represents also the effect of the position of the crank pin, thus giving the sum of all resistances and efforts at each point of the forward and the backward stroke. It shows that the dead point of the steam end occurs when the air pressure is light, demanding but small duty from the fly-wheel. It shows also that while the pressure of the air upon the piston is 60 pounds, its effort upon the crank-pin is only 45 pounds on the forward and 53 pounds on the return stroke, owing to the position of the pin in its circle of rotation.

This arrangement insures a very much nearer approach to parallelism between the power and the resistance at all points of the stroke than is obtained in ordinary machinery, where the resistance is constant and the power is transmitted through a revolving crank.

These machines are now giving very satisfactory results at the tunnel near Bethlehem, N. J.

MINING SUMMARY.

Colorado.

We are indebted to the Georgetown *Mining Review* for January for the following interesting articles.

THE SAN JUAN MINES.

A great deal has been heard about San Juan during the summer and fall of 1872, and for some time news from that country was received with as much incredulity as information from the quartz and garnet prospectors of Arizona. As winter, however, has driven the miners into the valley, and brought them in contact with the rest of the world, nothing but what is favorable has been heard of the new fields, and it must be confessed that San Juan promises to become an important and valuable mineral district. Mr. Kendal of Denver spent the best part of last summer and fall in the new Eldorado, prospecting and securing some of his best locations, and has kindly given us considerable information concerning the country, which we have every reason to believe is not exaggerated or incorrect.

Every one has heard of the Little Giant Lode. It may be considered as the center of operations, inasmuch as being the first discovered, it has formed the nucleus for the miners' camp and the cause of subsequent results. The Little Giant was located in '69 by two miners named French and Johnson who tried in vain for several years to interest monied men in its development. Finally it was bought by Fletcher and Hamilton for the sum of $36 000, one quarter of which was cash and the remainder payable during the winter. The buyers toward the close of the mining season brought in crushing and amalgamating machinery, and were intending in the coming spring to open the mine, and treat the ore on the spot by raw amalgamation. It is reported at present that they have failed to come to time on the remaining purchase money, and the original owners (French and Johnson) have burned the papers and cancelled the sale. When it is considered that hardly any work has been done upon the lode as yet, and under how many difficulties mining must be prosecuted there for several years to come, the price offered is in itself a good index of the value of the country as estimated by practical miners.

To reach the mines from the plains the shortest and best route is by the valley of the Huerfano to Sangre de Christo Pass, which leads from the Range into San Luis Park. Going westward the Rio Grande del Norte is struck, following up that river the divide is reached which separates the tributaries of the Gulf of California from those of the Gulf of Mexico. On the western slope of the Range are the head waters of the Animas river and the new mines. These are incorrectly called the San Juan mines, the true name of the Range in which they are found being Sierra la Plata. All important discoveries have so far been made almost entirely upon the western slope of the divide and within a radius of five or six miles around the Little Giant.

The formations are new and interesting. The veins have every appearance of true fissures, standing quite perpendicular, and between solid granite walls. Unlike most of the Colorada lodes now opened they exhibit no general course, but run towards all points of the compass, and cross each other at all conceiveable angles. Not more than a dozen of those located have required any search beyond the surface, the majority either crop out clear of the ground, and are traceable for hundreds of feet like low walls or are plainly exposed on the bare rock of the mountain side. They have generally been found above timber line, where the mountain is almost completely destitute, not only of vegetable life but of soil and debris. They are easily traced, and a very fair estimate of their value arrived at without extensive development.

Among the most prominent are the Little Giant, Bear, Green Mountain Boy, Blue Stone, Shenandoah, Comstock, Little Major, &c., &c., the first named being so far the representative lode of the district.

The Little Giant lies on the left side of Arastra gulch, nearly on the edge of timber, and having a course about parallel with the gulch. It lies clearly exposed for nearly 800 feet, and can be traced as accurately as a well worn trail along the mountain. It is distinctly a gold lode so far as opened, though liable at depth to change to silver as all the other veins are entirely argentiferous. The crevice is narrow, scarcely exceeding 18 inches, and showing a gangue rock of white quartz containing seams of pay, consisting of free gold, iron pyrites, and argentiferous galena. Some specimens look enormously rich, and a fair average of the vein material would undoubtedly give a large assay. A gorge runs from the top of the mountain to the gulch below, in crossing which the Little Giant is very favorably exposed for drifting purposes. Advantage has been taken of this and an adit driven in some twenty feet upon the vein.

Directly below is a ten foot silver lode, which crosses the Little Giant. Above them, and nearly on the crest of the mountain, is a huge crevice, fifty feet in width, winding along the slope like an immense embankment. Its walls are very distinctly marked, and pay is visible from the surface. It is called the Green Mountain Boy. Three miles off, what is believed to be the same vein has been again struck and named the Shenandoah. Neither of these have been opened to any extent.

The Bear lode, the property of Mr. Kendall, is an example of one of the curious freaks of nature. Instead of projecting above the surface, it has sunken or been washed out 8 or 10 feet in depth, leaving the walls standing out on either side, forming, it would seem, a very favorable ditchway. The ore from this lode has every appearance of being rich and constant in quantity. Most of the San Juan ore is quite similar to the Georgetown silver ore, containing, however, generally a percentage of copper.

The mountains of the San Juan or Animas district are steep and high, and show the traces of deep and heavy slides upon their slopes. In many places, and especially above timber line, the bed rock is stripped clean, and the course of out-cropping lodes can be plainly traced from prominent points miles away. But little prospecting has been done for blind or hidden lodes nearer the base of the mountains. Some, however, have been found, and it is evident that patient search is only required to uncover as good and rich veins as have yet been found.

How much these mines will add to the wealth of Colorado can only be determined when good and sufficient means of comunication are opened between them and the Plains. Probably a year will pass before anything extensive can be attempted. No new district however that we know of gives a better promise of successful mining operations in the future.

THE TUNNELS OF CLEAR CREEK COUNTY.

The following is a list of the tunnels now being driven in this vicinity, with the progress made and the probable cost of the same as far as we have been able to collect the data.

The Eclipse tunnel situated on Griffith Mountain near the Steward Silver Reducing Co.'s Works, is now 630 feet long. The work is being done by contract. The rock is very hard. Only one lode of importance has been crossed and this has not yet been developed. The crevice where the lode was cut is quite large but the mineral vein is only two inches thick. The cost of driving the tunnel has been about $35 per foot. The Eclipse tunnel is a New York enterprise.

The Douglass tunnel situated on Douglass Mountain owned by some of the same parties who are interested in the Eclipse tunnel, is now 280 feet long. The end of the tunnel is now about 100 feet from the New Philadelphia lode. The cost of the tunnel has been $30 per foot.

The Helmick tunnel, situated on Leavenworth Mountain, opposite and running parallel with the Marshall Tunnel, is now 520 feet long. It will cut the same veins as the Marshall tunnel, striking them at a point 800 feet east and 400 feet deeper than that tunnel. Already three lodes have been struck, all of which look well and would likely pay for working. They show wide crevices and well defined walls. This property is owned by Washington City capital. The tunnel has cost $30 per foot.

The Baltimore tunnel, situated on Brown Mountain, owned by Baltimore City capital, is now 680 feet long. It has cut four lodes, one of which, supposed to be the Terrible, is now being developed, with flattering prospects. It will cut all the valuable veins of Brown Mountain. The company has already spent $100,000

The Burleigh tunnel, situated at the base of Sherman mountain, is now 1350 feet long. It is being driven by contract, running night and day 8 hour shifts. The present cost to date is probably $150,000. The progress being made is about 20 feet per week.

The Marshall tunnel, situated on Leavenworth Mountain, is 1300 feet long and has but nine lodes, which belong to the company; and one owned by the Equator or Bowman Company. This is the great Equator lode which has yielded about two hundred thousand dollars worth of silver, although not worked constantly, legal difficulties keeping it closed up a considerable part of the time since its discovery. The other lodes, owned by the Marshall Tunnel Company, are true fissure veins and promise to prove very valuable. A number of these are now being developed with very encouraging results. The work now in progress is merely to develop and ascertain the true value of the veins cut, with a view to extensive mining operations in the future. It is the deliberate intention of this company to make a hole clean through Leavenworth Mountain, a distance of 3912 feet, and from what has already been done we see no good reason why they will not accomplish this herculean task. In doing this they will cut a nest of the most valuable silver veins, known to exist in the terri-

tory. At present we know of fifty lodes which will be intersected, and doubtless there are others which have not yet been discovered. The Marshall tunnel properly stands at the head of all the tunnel enterprises now in operation in the territory.

The Robinson tunnel, owned by the Marshall S. M. Co., is located on the east slope of Leavenworth Mountain, a little north of and about 400 feet above the Marshall tunnel. It was run to cut the Compass and Square, and lodes No. Four and Five. Drifts from this tunnel have been run on all of the above named veins which are now being profitably worked.

The Bruce, Churchill and Mairs are all short tunnels in the same vicinity. They are run by the Marshall S. M. Co. Several different lodes are worked through them, and quite an amount of rich ore has been taken out.

The Kertly and Roberts tunnel is about 200 feet east of and 300 feet above the Marshall tunnel. It cuts the Equator, the Compass and Square, and tunnel lodes No. Four and Five, and the Saco. The east end of the last named property has produced $61,500 during the last six months. The Equator has been worked through this tunnel for some time, and the other lodes mentioned are to be worked at this point by lessees.

The Antelope tunnel, which is situated in the gulch between Sherman and Republican mountain, is 125 feet long, and has 120 to go before striking the Antelope lode. It is being driven night and day with eight hour shifts.

Utah.

CPHIR DISTRICT.

From the Salt Lake *Herald* of Jan. 15:

ZELLA MINE.

The road leading to Lion hill and this mine has been, after several attempts, broken out so that supplies can now be carried forward with facility. No reduction of the working forces, nor temporary suspension of the mining operations is anticipated. The usual force of twenty-five men is steadily employed in and around this mine. A drift is being run from the old works of the Zella westward, to connect with the Silver Chief works. The object is to take the ores of the Zella out through the Silver Chief shaft; this will greatly facilitate the production of the mine. In a former summary we stated that Silver Chief had passed into the hands of the owners and claimants of the Zella mine. Since the breaking out of the road, teams are constantly passing laden with ore from this mine, which is being taken to the mill of the company for reduction. At this writing no given amount of ore is being daily hoisted, but so soon as the new connections are made with the working shaft of the Silver Chief mine the quantity will be largely increased, and so soon as the weather will permit a sufficient supply of water to pass down the canyon to the company's works, they will be started. Then we expect to chronicle the extraction of many fine silver bricks, for certainly the ores to be reduced are of excellent quality.

SUNNY SIDE.

No ores are being taken from this mine. Explorations preparatory to extracting large quantities in the spring are being quickly pushed forward.

MOUNTAIN LION.

The work under progress in this mine is that of exploration. No new ore bodies have been reached lately.

The remaining work now under way in this group is that of prospecting. We have no new finds to mention among the many prospects that are going ahead vigorously.

SILVERADO AND CHLORIDE HILL GROUPS.

No work that is yielding any ore is being done in these two groups at present, but many promising prospects will be worked early in the spring.

SILVER SHIELD AND M'CULLOM GROUPS.

All the mines of these groups are idle, but many expect to resume work soon.

HIDDEN TREASURE GROUP.

Upon the Hidden Treasure mine about eight men are employed upon the summit incline. Within a few days past some fine ore of a sulphide character has been found in this incline, but so far no large ore body has been reached. Owing to the snow blocking the road leading from the mine to Dry canyon, no ore has been forwarded to the smelting works at Stockton.

CHICAGO.

This mine is being steadily worked and the ores piled away in the ore house. We have no new strikes to mention in this mine.

DRY CANYON GROUP

The mines of Jacobs & Co., including the Fourth of July and Kearsage, have been suspended temporarily, because of the bad weather preventing a sufficient supply of ore being hauled from the canyon to Stockton to keep the furnaces in operation.

MONO.

No ore has been extracted here for the past ten days. Putting in a whim and laying down a new track in the incline is the cause. The ore that was in the ore house when the extraction was suspended has been sacked, and about one thousand sacks out of twenty-five hundred have been boated down the hill ready for shipment. The extraction of ore will be resumed at an early day.

CONVERSE, UTAH QUEEN AND MIAMI.

The complicated improvements upon these mines have been greatly retarded on account of not getting the materials ordered. The extraction of ore and the explorations for future use progress steadily. We learn that the expected difficulty between these mines and Owyhee Bell has been satisfactorily adjusted.

We have no new finds to mention among the very many prospects that are being worked in this locality.

MISCELLANEOUS.

The continued stormy weather has put a stop to all outside mining and prospecting, only those that can boast of shelter continue to work. The reduction works, of all characters, have also stopped for the same reason. We do not expect to see mining and milling under good headway again till spring fairly opens.

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

I. The next meeting of the Institute will be held Tuesday, February 18, 1873, in Boston, Mass. Prof. T. STERRY HUNT, and Prof. W. H. PETTEE are the local Committee of Arrangements. The Local Committee announces that the meetings will be held in the building of the Boston Natural History Society, Berkeley street, corner of Boylston street. Members will make the Parker House, School street, their head-quarters. The committee has been in communication with the engineers and contractors of the Hoosac Tunnel, and have received the kindest assurances of welcome to the members. It is expected that the meeting will close with a visit to the tunnel, taking that great work on the return home.

II. All members and Associates who pay their dues ($10,) for each current year, strictly in advance, will have sent to their address, regularly and weekly, the ENGINEERING AND MINING JOURNAL, which is the organ of the Institute, and will contain the proceedings and transactions, and all important papers read before the Institute and all notices of meetings. Back numbers cannot, as a general rule, be sent.

Those members and associates who have not paid their dues for the current year, are requested to do so at once. Money may be sent in postal orders, checks or bank bills, to the Secretary, THOMAS M. DROWN, 1123 Girard street, Philadelphia, Pa.

III. It is expected that the more important papers, read before the Institute, and the debates thereon, will be published in annual or occasional volumes to which those Members and Associates will be entitled who have paid their dues.

IV. All authors of papers are requested to notify the Secretary in advance of the meetings, giving the subject and length of their papers. Attention is also called, in this connection, to Rules 12 and 13.

V. The ninth rule has been amended, so that there will be hereafter three meetings a year, in February, May and October.

THOMAS M. DROWN, Secretary.
1123 Girard street, Philadelphia, Pa.

Advertisements.

The special advantages of the ENGINEERING AND MINING JOURNAL, *as a medium for advertisers, are so great and so widely known that it may seem almost needless to call attention to them. It is extensively circulated among the engineers of the country and takes a position in this respect before any other publication of the kind. It has a large and constantly increasing circulation among miners and mine owners, and men connected with mining operations generally. As it is the only paper in the country that makes this subject a specialty it has this field entirely to itself, and is the only direct and reliable means of reaching this class of persons. Being kept on file by almost every subscriber, it is doubly valuable as a permanent means of keeping an advertisement before the public. It is the Organ of the* AMERICAN INSTITUTE OF MINING ENGINEERS, *and is regularly received and read* BY ALL THE MEMBERS AND ASSOCIATES *of that large and powerful society,* THE ONLY ONE OF THE KIND IN THIS COUNTRY. *It is therefore the best medium for advertising all kinds of machinery, tools and materials used by engineers or their employes. It is the recognized organ of the coal trade, and is taken extensively by the trade throughout the country, and presents the very best means of reaching that very important class of men.*

Rates of Advertising.

The rates of advertising, compared with those of other weekly industrial publications, are very low, especially when the class of consumers among which its large circulation is almost entirely confined, is taken into consideration.

Back Page.....40 cents a line.
Inside Pages.....25 cents a line.
Engravings may head advertisements at the same rate per line, by measurement as the letter-press.

P. H. VAN DER WEYDE, M. D.,
(Late Professor of the N. Y. Medical College, Mechanics, etc., at the Cooper Institute, and of Industrial Science at the Girard College, Philadelphia.)
Analytical & Consulting Chemist and Engineer
236 Duffield street, Brooklyn.
Office MANUFACTURER AND BUILDER, 37 Park Row, New York City.

MAYNARD & VAN RENSSELAER,
Mining and Metallurgical Engineers, Experts in Iron, Analytical Chemists,
24 Cliff Street, New York.
GEO. W. MAYNARD, SCHUYLER VAN RENSSELAER.

DROWN & CORLISS,
ANALYTICAL CHEMISTS AND CONSULTING METALLURGISTS.
1123 GIRARD STREET,
PHILADELPHIA.
THOMAS M DROWN. GEORGE F. CORLISS.

SCHOOL OF MINES, COLUMBIA COLLEGE.
FACULTY.—F. A. P. BARNARD, S.T.D., LL.D., PRESIDENT; T. EGLESTON, JR., E. M., Mineralogy and Metallurgy; F. L. VINTON, E. M., Civil and Mining Engineer; C. F. CHANDLER, PH. D., Analytical and Applied Chemistry; JOHN TORREY, M.D., LL.D., Botany; C. A. JOY, PH. D., General Chemistry; W. G. PECK, LL.D., Mechanics; J. H. VAN AMRINGE, A.M., Mathematics; O. N. ROOD, A.M., Physics; J. S. NEWBERRY, M.D. LL.D., Geology and Paleontology. Regular courses in Civil and Mining Engineering; Metallurgy; Geology and Natural History; Analytical and Applied Chemistry. Special students received for any of the branches taught. Particular attention paid to Assaying. For further information and catalogues, apply to
DR. C. F. CHANDLER,
Nov. 21:1y Dean of the Faculty.

GENUINE CHESTER EMERY.
AMES.
EMERY CLOTH. TRADE A MARK. **EMERY PAPER.**
BEST QUALITY. LOWEST PRICES
E. V. HAUGHWOUT & CO.,
25 Park Place. NEW YORK.
Feb.4.4t

WANTED.
AN energetic young man wants a situation as Engineer or Overseer in some manufactory. Has had good experience, is strictly temperate, and can come well recommended. Would prefer a situation where he would be able to rise by his merits. Is willing to go to any part of the country. Please address H. J., care Engineering and Mining Journal Feb.4.2t

WOOD ENGRAVING
EXECUTED AT THE OFFICE OF
The Engineering and Mining Journal.
27 PARK PLACE, NEW YORK CITY.

"ENGINEERING."
"The leading Engineering Journal of the world," indispensable to every Civil, Mining, or Mechanical Engineer, can now be obtained post-paid at $9 30 currency, by remitting Post Office order to NEW YORK OFFICE "ENGINEERING, 52 Broadway.

MISCELLANEOUS.

WM. A. SWEET, Pres't. GEO. W. HARWOOD, Treas. FRED. B. CHAPMAN, Sec'y.

SWEET'S MANUFACTURING CO.,

SYRACUSE, N. Y.,

MANIPULATORS OF

Bessemer Steel,
Siemens Martin Steel,
Cast Steel,
Blister Steel.

MANUFACTURERS OF

Sweet's Cast Steel Crow Bars,
Sweet's Cast Steel R. R. Bars,
Sweet's Oil-tempered Seat Springs,
Sweet's Excelsior Steel Tire,
Swede's Spring Steel,
Cast Spring Steel,
English Spring Steel,
Sleigh Shoe Steel,
Cutter Shoe Steel,
Frog Point Steel.

Nov. 19:1y

SUPERIOR RAIL MILL.—CAPACITY: 1,000 TONS PER WEEK.

Harbaugh, Mathias and Owens,

Manufacturers of

RAILROAD IRON,

Office, corner Fifth Avenue and Smithfield Street, Pittsburgh.

Our central location enables us to draw from both sides of the Allegheny Mountains Metals and Ores best adapted for making a No. 1 Rail, and together with our Improved Machinery, are a sufficient guarantee of our ability to produce Rails of a quality unsurpassed for durability and strength, by any oreign or domestic manufacture.

New Patterns, of any desirable weight, made to order on Short Notice.

We respectfully solicit orders for New Rails, or Re-rolling. June 25.1y

UNITED ROYAL SMELTING WORKS

OF THE

KINGDOMS OF PRUSSIA AND SAXONY.

ENERAL AGENCY—R. J. ROBERTSON, HAMBURG, GERMANY,

Whose representative for the United States,

R. ROBERTSON, 149 BROADWAY, NEW YORK,

Is ready to receive consignments of

ORE and all kinds of FURNACE STUFF

For the above-named Works.

Full particulars given on application. Oct. 8-tf

JOHN J. ENDRES,

Mining and Civil Engineer,

MANUFACTURER OF MACHINERY FOR MINING AND SMELTING PURPOSES,

SPECIALITY:

Patent Ore and Coal Crushing and Washing Machines.

BUILDER OF IMPROVED COKE OVENS AND MACHINERY FOR DISCHARGING THE SAME.

Office and Works:

SOUTH PITTSBURGH, PA.

Nov. 26:3m

W. B. COGSWELL,

Civil & Mechanical Engineer.

SPECIALITY:

Blast Furnace Construction.

P. O. Address

Franklin Iron Works,
Oneida County,
Nov. 19:1y N. Y.

MISCELLANEOUS.

JOHN A. GRISWOLD, ERASTUS CORNING, ERASTUS CORNING, JR., CHESTER GRISWOLD.

JOHN A. GRISWOLD & CO.,

PROPRIETORS OF THE

RENSSELAER IRON WORKS,

TROY, N. Y.

Bessemer Steel Works, Fort Edward Blast Furnace and Columbia Blast Furnace

MANUFACTURERS OF PIG IRON, RAILROAD, MERCHANT AND SHIP IRON,

Bessemer Steel Rails, Axles, Tyres, Shafting Plates and Steel Forgings,

OF ALL DESCRIPTIONS.

Office in New York, No. 56 Broadway.

May 17:1y

LEHIGH ZINC COMPANY.

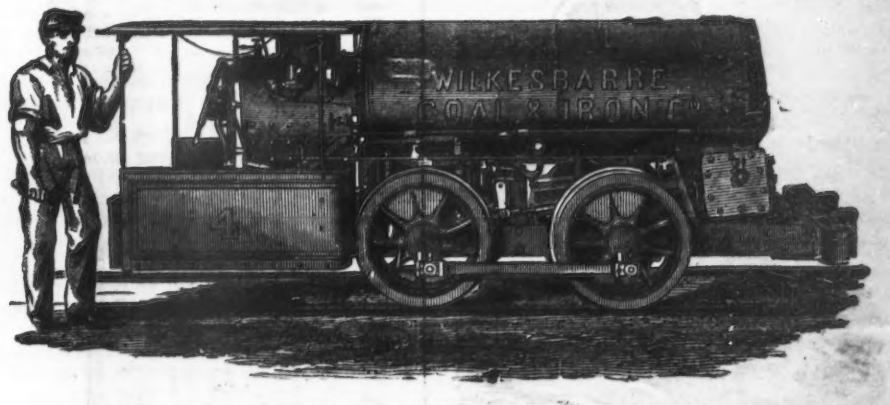
GORDON MONGES, Treasurer. B. C. WEBSTER, President

WORKS, BETHLEHEM, PA OFFICE, 333 Walnut Street, Philadelphia.

JOHN JEWETT & SONS, AGENTS, 182 FRONT STREET, NEW YORK.

OXIDE OF ZINC, SPELTER, SHEET ZINC.

Jun28:1y SPIEGELEISEN CINDER FOR BLAST FURNACES.



IMPROVED DIRECT-ACTING MINING LOCOMOTIVE

Gauge, two feet six inches or upwards; Hight above rail, five feet four inches; Width over all, five feet one inch adapted to burn Anthracite or Bituminous coal or coke.

Materials and Workmanship Equal to those in Full Gauge Railroad Locomotives.

Guaranteed to pass curves of twenty-five feet radius and haul on a level track in good condition

Three Hundred and Forty Gross Tons of Cars and Load

For Photograph and full particulars, address

Feb:7-1y:ecw M. BAIRD & CO., Baldwin Locomotive Works, Philadelphia.

BLAKE'S STONE BREAKER.

The office of this Machine is to break Ores and Minerals of every kind into small fragments, preparatory to their further comminution by other machinery.

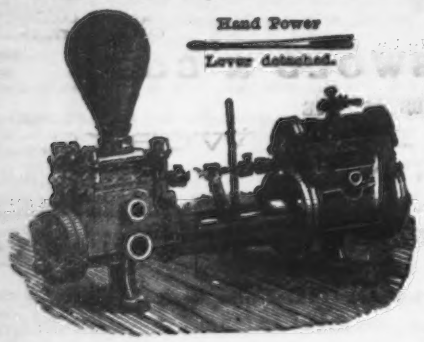
This machine has now been in use, enduring the severest tests, for the last ten years, during which time it has been introduced into almost every country on the globe, and is everywhere received with great and increasing favor as a labor-saving machine of the first order.

Illustrated circulars, fully describing the machine, with ample testimonials to its efficiency and utility, will be furnished on application, by letter to the undersigned.

☞ The Patents obtained for this machine in the United States and in England having been fully sustained by the courts, after well contested suits in both countries, all persons are hereby cautioned not to violate them; and they are informed that every machine now in use or offered for sale, not made by us, in which the ores are crushed between upright convergent faces or jaws actuated by a revolving shaft and fly-wheel, are made and used in violation of our patent.

Mch. 14-1y **BLAKE CRUSHER COMPANY, New Haven, Conn.**

MACHINISTS' SUPPLIES.

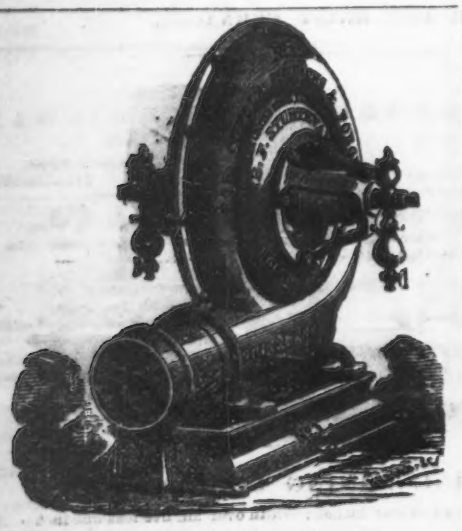


GEO. F. BLAKE & CO.,
MANUFACTURERS OF BLAKE'S PATENT
STEAM PUMPS.
No. 79 LIBERTY STREET, NEW YORK.
Factory 61 Chardon St., Boston, Mass.

A specialty made of the manufacture of DOUBLE-ACTING PLUNGER PUMPS for mining purposes—combining economy of space, capacity, and great durability. All wearing parts made of composition metal.

Also, Boiler Feed Pumps, Fire Pumps, Tank Pumps, Wrecking Pumps, etc., etc.

Send for Illustrated Price Circular. m-26 3m



B. F. STURTEVANT'S
PATENT IMPROVED
PRESSURE BLOWER,
FOR CUPOLA FURNACES AND FORGES.

Also manufacturer of the Sturtevant Patent Improved Fan Blower and Exhaust Fan. Send for illustrated catalogue.
B. F. STURTEVANT, 72 Sudbury street, Boston, Mass.
m29:1y

KROM'S PATENT DRY ORE
CONCENTRATOR
AND COMPLETE MACHINERY
FOR CRUSHING SCREENING
AND CONCENTRATING ORES.

Minerals and Ores in which the difference of specific gravity is so slight and which are also sometimes in such fine particles as to defy separation by any other machinery or method, are rapidly separated by this Concentrator.

Mr. W. Bement, of Georgetown, Col., concentrating Silver ores, says: "I am satisfied your machines can not be beaten; they are simple, require no power (comparatively,) and do not get out of order."

A comparison is challenged between the results obtained by the approved methods of water concentration and the complete system of dry-ore concentration in the amount of ore saved, quantity concentrated, economy of working, and comfort of the operators and workmen

Parties interested in mining are invited to call at No. 210 Eldridge street, New York, where they may see a machine in operation and have samples of their own ores crushed and concentrated.

For information and circulars, apply to
S. R. KROM,
No. 210 Eldridge street, New York City.

WILLIAM F. McNAMARA,
SOLICITOR OF PATENTS
AND COUNSELLOR-AT-LAW.
No. 37 PARK ROW, NEW YORK, ROOM 22
Advice in Patent Law given free. mar 6:tf

MISCELLANEOUS.

The Bessemer Steel Works,
of John A. Griswold & Co.
Troy, N. Y., May 3, 1872.

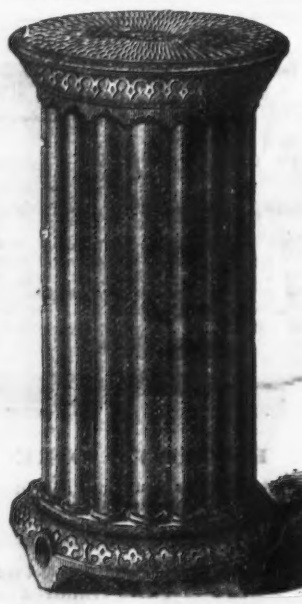
B. F. Sturtevant, Boston, Mass..

Dear Sir, We have changed your No. 8 for your No. 9. Pressure Blower. The time in melting is about the same with either Blower. We are melting 225,000 lbs. (112½ tons,) Pig Iron daily, (20 hours running time.) It works well.

BARNEY MEE, Supt.

ENGINES, IRON WORK, ETC.

NASON'S VERTICAL TUBE RADIATORS IN VARIOUS SIZES AND PATTERNS.



JOSEPH NASON & CO., 6 BEEKMAN ST., corner of Gold street.—WROUGHT and CAST-IRON PIPES; all kinds of STEAM and GAS FITTINGS; Apparatus for WARMING and VENTILATING BUILDINGS.
JOSEPH NASON. HENRY R. WORTHINGTON.
nov29-1y

Something New!

ZELL'S
Illustrated Monthly Magazine,
CONDUCTED BY L. DECOLANGE, LL.D.,
Editor of ZELL'S Encyclopedia, &c., &c.

The first number of this new and beautiful serial will be issued in September, 1872. It will be especially the magazine for the cultured home, always up to the practical as well as the scientific spirit of the times.

It will be largely devoted to information concerning foreign and home countries, especially with those places remote from the general rush of travel. This information will be profusely illustrated by fine engravings from original sketches. The recent discoveries in science, relating to explorations and journeyings of travellers, inventions of pains-taking laborers in the field of the practical arts, the discoveries of celebrated chemists, physicians, botanists and mineralogists will be noted as they occur.

An original illustrated article on Naples will be published, besides other original tales, sketches of life and character, poetry and various literary papers from the pens of writers of the first talent.

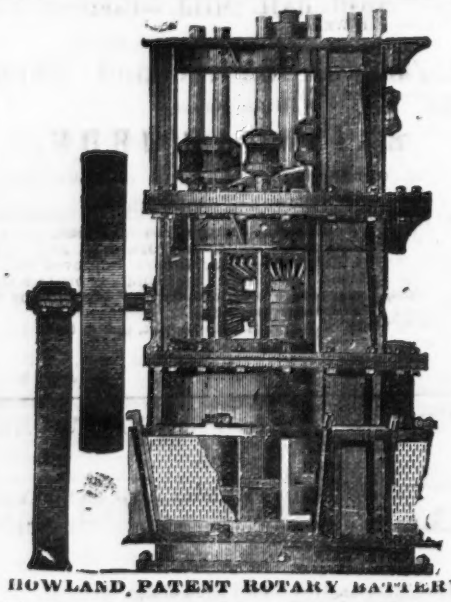
The editorial staff will be under the direction of L. DE COLANGE, LL. D, so well and favorably known as the editor of "ZELL'S ENCYCLOPEDIA."

The publisher will spare no pains or expense to make this magazine well worthy the reading public, and has placed the subscription price so low as to be within the reach of all.

Subscription price, $2 00 per annum.
Single numbers 20 cents.
A specimen copy will be sent to any part of the United States on receipt of 10 cents in postage stamps.

T. ELLWOOD ZELL, Proprietor,
17 and 19 South Sixth street, Philadelphia,
sept8:3m 5 Beekman street, NewYork

MINING MACHINERY, ETC



HOWLAND PATENT ROTARY BATTERY

of 12 stamps. It requires no frame to put it up. The best Battery ever used for amalgamating gold, or crushing silver ores, dry or wet. Can be put up on a mine in running order for one-half the price of the straight battery, and in three days after its arrival at the mine. 12-stamp battery, 20,000 pounds, with frame complete; 6-stamp battery, 7,000 pounds. Every mill run at shop before shipping.

CALIFORNIA STAMP MILLS,

All the various styles of Pans, Amalgamators, Rock Breakers, Separators, Settlers, Concentrators, Dry or Wet, for working Gold, Silver or Copper Ores, the same as built in California and at lower prices. SHOES AND DIES made of the best white iron. Send sizes and we will make patterns and forward Shoes and Dies at low prices. Engines, Boilers and fixtures, and other Machinery made to order.

Send for a Circular.
Address MOREY & SPERRY,
Jan 6:6m 96 Liberty Street New-York.

COOPER'S GLUE AND REFINED GELATINE

COOPER HEWITT, & CO.,
NO. 17 BURLING SLIP, NEW YORK.
Bar Iron, Braziers' Rods, Wire Rods, Rivet and Machinery Iron, Iron and Steel
Wire of all Kinds, Copperas.
&c., &c.

RAILROAD IRON, COOPER WROUGHT IRON BEAMS AND GIRDERS,
Martin Cast-Steel. Gun-Barrel and Compcnent Iron,
PUDDLED AND REFINED CHARCOAL BLOOMS,
Ringwood Anthracite and Charcoal Pig Iron.
Works at Trenton and Ringwood, N. J.
May 17:1y

DENISON'S COOLING AND LUBRICATing Compound will immediately cool a hot journal when in motion. Send for a Circular.
POSTS & KALKMAN, Manufacturers,
Sept. 17:6m 111 Liberty Street, New York.

MISCELLANEOUS.

THE TRADE JOURNAL
OF PHILADELPHIA.

The Representative Paper of the Manufacturing and Commercial Interests of Philadelphia.

Published every Saturday, on a large triple sheet, comprising

Seventy Columns,

and embracing Weekly Reports of the LEADING INTERESTS of the Country, with able Editorials on the TOPICS OF THE DAY.

It circulates in every important county in the

Southern and Western States,

and to a large extent in the

Middle States.

It reaches, through hotels and business houses, a class of customers especially desirable to obtain, making it a valuable advertising medium.

Subscription $3.00 per Annum.

PUBLISHED WEEKLY

BY THE

SOUTHERN AND WESTERN PUBLISHING AND PRINTING COMPANY,

125 South Third Street,

PHILADELPHIA.

Nov. 5.3mos

THE

MECHANIC'S MAGAZINE

OF

SCIENCE.

NEW PATENTS, AND ALL MANUFACTURES, ENGINEERING, BUILDING, RAILWAYS, TELEGRAPHY, SHIP-BUILDING, FACTORY NEWS, ETC., ETC.

The Well-known **LONDON MECHANIC'S MAGAZINE, Established 48 Years,** Is the Oldest Technical Journal in the World.

It will be mailed to Subscribers in the States, for $3 50 half yearly.

166 Fleet Street, London.

CLAY CARBONATE COPPER ORE,

(SUITABLE FOR WET PROCESS.)

1000 Tons 5 per Cent Yield.

FOR SALE AT VERY LOW FIGURES.

WHEATLEY & HARVEY,

Schuylkill Copper Works,

PHOENIXVILLE,

Jan. 14:6ms PENNSYLVANIA.

COPPER ORES WANTED.

WHEATLEY & HARVEY,

"SCHUYLKILL COPPER WORKS,"

PHOENIXVILLE,

Jan. 14:6m PENNSYLVANIA.

TUCK, FRENCH & GODDARD

SUCCESSORS TO

POST & GODDARD and J. A. FRENCH & CO.,

No. 111 Liberty St., New York.

AGENTS FOR THE

New York Tap and Die Co.,
Centre Brook Manufacturing Co.,
New Jersey Rubber Co.,
Goddard Solid Emery Wheel,
Manufacturers' Leather Belting Co
and General Agents for Burch's
HELICAL HAND DRILL.

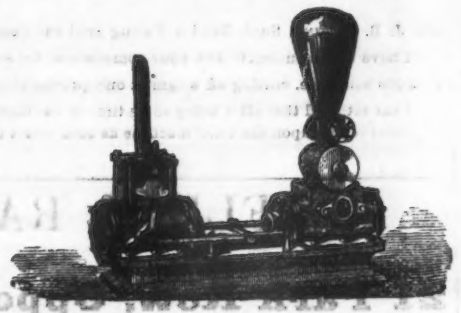
We have largely increased our facilities for promptly accommodating our customers. All orders promptly filled.

Address P. O. Box 3362. Junell:1y

STEAM PUMPS.

STEAM PUMPS, Double Acting. Bucket Plungers are the best. Send for Circular. Valley Machine Co., Easthampton, Mass

Niagara Steam Pump Works.



This Pump has taken the first premium at every Fair in the United States where there has been a practical test.

CHARLES B. HARDICK,

No. 23 ADAMS STREET, BROOKLYN, N. Y.,

Sole Manufacturer of

HARDICK'S PATENT DOUBLE-ACTING

STEAM PUMPS AND FIRE ENGINES,

Patented in England, Belgium and France. Send for circular. feb-13-1y

HYDRAULIC WORKS.

MANUFACTORY,

BROOKLYN, N. Y.

Steam Pumping Engines, Single and Duplex, Worthington's Patent, for all purposes, such as Water Works Engines, Condensing or Non-condensing; Air and Circulating Pumps, for Marine Engines; Blowing Engines; Vacuum Pumps, Stationary and Portable Steam Fire Engines; Boiler Feed Pumps, Wrecking Pumps,

MINING PUMPS,

Water Meters, Oil Meters; Water Pressure Engines. Steam and Gas Pipe, Valves, Fittings, etc. Iron and Brass Castings.

Send for Circular.

jan2-1y H. R. WORTHINGTON, 59 Beekman street, New York.

J. CLAYTON'S

Patent Fly Wheel

STEAM PUMP,

AND

STEAM ENGINE

COMBINED.

These pumps are the cheapest first-class pumps in the market.

All sizes made to order at short notice.

JAMES CLAYTON, 24 & 26 Water st.

Nov18-tf Brooklyn, N. Y

Office: 50 & 52 John street, New York.

STEAM ENGINES.

Portable and Stationary. "The Best Cheapest, most Durable." Improved Circular Saw Mills, Screw and Lever Set. Send for Circular.

UTICA STEAM ENGINE CO., UTICA, N. Y.

G. G. YOUNG, General Agent,
Nov. 12:6mos 42 Cortlandt Street, New York.

COAL SHIPPERS.

THE NEWBURGH ORREL COAL COMPANY

Mines at Newburgh, Preston Co., W. Va.
Company's Office, No. 52 S. Gay St. Baltimore, Md.
C. OLIVER O'DONNELL.....President.
CHAS. MACKALL.....Secretary

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York, the Brooklyn and Citizens' Gas Light Companies of Brooklyn, N. Y., the Baltimore Gas Light Company of Baltimore, Md., and Providence Gas Light Company, Providence, R. I.

The best dry coals shipped, and the promptest attention given to orders. sep21-1y

COXE BRO.'S & CO., CROSS CREEK COLLIERY, MINers and Shippers of the Celebrated

Cross Creek Free Burning Lehigh Red Ash

COAL.

FROM THE BUCK MOUNTAIN VEIN.

OFFICES:

Philadelphia, No. 206 South Fourth street.
Drifton, Jeddo P. O., Luzerne Co., Pa.

Agent in New York, SAMUEL BONNELL, Jr., Room 43, Trinity Building, feb-1 111 Broadway.

DETMOLD & COX,

ANTHRACITE AND BITUMINOUS

COALS.

Office, 40 Trinity Building, New York. jan 23-1y

STEPHEN S. LEE & SON,

Miners and Shippers of

GEORGE'S CREEK COAL

SWANTON MINES,

No. 49 West Lombard street, may28-tf BALTIMORE.

MARYLAND COAL CO.,

Miners and Shippers of the best George's Creek Cumberland Coal.

Office No. 12 Trinity Building.
W. W. BRAMHALL, Secretary & Treasurer.
A. CHAMBERLIN, President.
jan23.1y JOHN K. SHAW, Vice President

THE DESPARD COAL COMPANY OFFER THEIR Superior DESPARD COAL to Gas Light Companies throughout the country.

MINES IN HARRISON COUNTY, West Virginia.
Wharves, Locust Point, } Baltimore.
Company's Office, No. 29 South st. }

AGENTS:

PARMELEE BROTHERS, No. 32 Pine street, New York. BANGS & HORTON, No. 31 Doane street, Boston.

Among the consumers of Despard Coal we name Manhattan Gas Light Co., New York; Metropolitan Gas Light Co., New York; Jersey City Gas Light Co., Jersey City, N. J.; Washington Gas Light Co., Washington, D. C. Portland Gas Light Co. Portland, Maine.

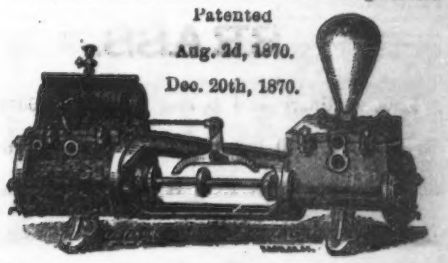
☞ Reference to them is requested. may30-1y

THE SELDEN DIRECT-ACTING

STEAM PUMP

A. CARR, Manufacturer & Proprietor

Patented
Aug. 2d, 1870.
Dec. 20th, 1870.



Combining simplicity and durability to a remarkable degree. Its parts are easy of access, and it is adapted to ALL PURPOSES for which Steam Pumps are used.

AS A MINING PUMP

It is unsurpassed. Also,

Steam, Gas and Water Pipe, Brass Work. Steam and Water Gauges, Fittings, etc. etc.

Send for Price-List and Circulars.

Address A. CARR,
feb15.72:24 43 Courtlandt, Street New York.

C. F. A. HINRICHS,

ESTABLISHED 1601.

Sole Owner and Dealer in the celebrated all-metal Saint Germain or

GERMAN STUDENT'S LAMP.

Stachlen's Patent Lamps. These lamps give the steadiest and clearest light and are the safest in use, particularly suitable for Engineers' Miners' and Draftmen's Night Work. Also Importer of Fine Glassware, French China, Lava, Parian, Toys, Fancy Leather Goods, Clocks, Bronzes, Cutlery, Smokers' Articles, Masks, Looking Glasses, &c., &c.

Display and Retail Sales for the Holidays during December.

29, 31, 33 Park Place,
Oct. 26-6m NEW YORK.

Advertisements.

Advertisements admitted on this page at the rate of 40 cents per line. Engravings may head advertisements at the same rate per line, by measurement, as the letter press.

TO INVESTORS.

To those who wish to REINVEST COUPONS OR DIVIDENDS, and those who wish to INCREASE THEIR INCOME from means already invested in other less profitable securities, we recommend the Seven-Thirty Gold Bonds of the Northern Pacific Railroad Company as well secured and unusually productive.

The bonds are always convertible at Ten per cent. premium (1.10) into the Company's Lands at Market Prices. The rate of interest (seven and three-tenths per cent. gold) is equal now to about 8¼ currency—yielding an income more than one-third greater than U. S, 5-20s. Gold Checks for the semi-annual interest on the Registered Bonds are mailed to the Post-Office address of the owner. All marketable stocks and bonds are received in exchange for Northern Pacifics ON MOST FAVORABLE TERMS.

JAY COOKE & CO.,
NEW YORK, PHILADELPHIA, AND WASHINGTON,
Financial Agents Northern Pacific R. R. Co.
Jan. 7:tf

Patterson Brothers,

No. 27 Park Row, New York City

(P. O. BOX 3341,)

Commission Hardware Merchants

IMPORTERS AND RETAILERS OF

HARDWARE AND CUTLERY,

Offer at manufacturers' prices, wholesale and retail, a very complete assortment of

WATERBURY AND ANSONIA

BRASS.

Low, Ordinary and Spring Wire, No. 00 to 34 Sheet, No. 0 to 40, in width from ¼ inch to 24 inches, Sheet Copper, Sheet Iron, Hoop Iron; German Silver Wire, and Sheet German Silver; Tubing, Copper Wire, Silvered Wire, Iron Wire of all kinds; Steel Wire, Brass, Copper and German Silver Rod.

THE
American Trade Journal.

Particularly devoted to the general trade interests of the country, has an established commercial circulation exceeding

40,000 COPIES,

extending throughout the United States, and to Great Britain, Brazil, Mexico, Central America, Buenos Ayres, Chili, Australia and Japan.

It has been the agent for the successful introduction to notice and sale of American productions in the countries named; and, by a steadily increasing circulation in that direction, has proven the most valuable medium for our trade interests abroad as we as at home.

Published Weekly and Monthly under the auspices of the BOARD OF TRADE.

F. H. ROLLINS, 8 Church street, New York.
Oct.1.1.year

RAND & WARING DRILL AND COMPRESSOR CO.,

21 PARK ROW, OPPOSITE NEW POST OFFICE, NEW YORK.

Manufacturers of Air Compressors, Rock Drills, and Hoisting Machinery.

EASTERN AND AMBOY RR.,
TUNNEL, NEAR BETHLEHEM, N. J., February 3, 1873.

MR. J. B. WARING, Supt. Rand & Waring Drill and Compressor Co., 21 Park Row, New York:

I have been running two of your compressors for some time, and I am much pleased with them. They each drive four 4" drills with ease, cutting off steam at one-quarter stroke.

I am satisfied that after being some time in use they will be still more effective.

I will report upon the third machine as soon as set up and in running order.

C. McFADDEN.

LAFLIN & RAND POWDER CO.,

21 Park Row, Opposite Astor House, N. Y.,

invite attention to their facilities for delivering

BLASTING POWDER, SAFETY FUSE, ELECTRICAL BLASTING APPARATUS, &c.,

wherever required, from having nine manufactories in different States, beside agencies and magazines at all distributing points.

BACON'S
HOISTING ENGINES.

FOR MINES, BLAST FURNACES, PILE DRIVING, CONTRACTORS' USE, &c.
Adapted to Every Possible Duty.
COMPACT, STRONG, SIMPLE AND DURABLE.

Manufactured by
THE SPEEDWELL IRON WORKS,
OFFICE AND WAREROOM.....36 CORTLAND STREET, N. Y.
WORKS.....MORRISTOWN, N. J. jan9-1f

OTIS' SAFETY HOISTING MACHINERY,

Special adaptation for MINES and FURNACES.

Just Out—combining RAPIDITY of MOVEMENT, EASE of CONTROL and PERFECT SAFETY with GREATEST DURABILITY.

WORN PARTS CAN BE REPLACED IN A FEW MINUTES.

OTIS BROTHERS & Co.,....PATENTEES AND SOLE MANUFACTURERS.
OFFICE 348 BROADWAY, NEW YORK.....FACTORY AT YONKERS.
May 21:1 yr

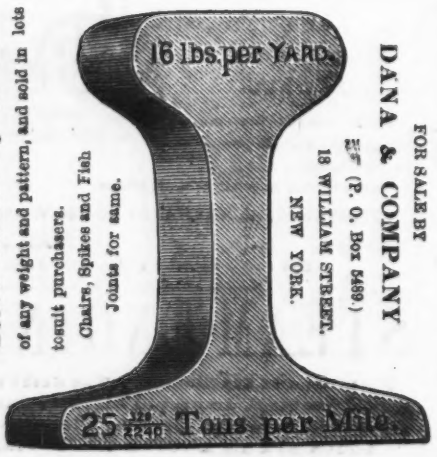
COAL YARD, QUARRY, AND CONTRACTORS' APPARATUS.

Andrews's Patents, Noiseless, Friction-Grooved, Portable and Warehouse Hoisters.
FRICTION OR GEARED MINING AND QUARRY HOISTERS.
For Hoisting and Conveying Material to any Distance by Wire Cables.
Smoke-burning Safety Boilers. Oscillating Engines, Double and Single, ½ to 100 horse-power. Centrifugal Pumps, 100 to 100,000 gallons per minute. Best Pumps in the world; pass mud, sand, gravel, coal, grain, etc., without injury.
All light, simple, durable and economical.
Send for circulars.

WILLIAM D. ANDREWS & BRO.,
oct-15-1y 414 WATER STREET, NEW YORK.

RAILROAD IRON FOR MINES.

Stock Constantly on Hand of any weight and pattern, and sold in lots to suit purchasers.
Chairs, Spikes and Fish Joints for same.



DANA & COMPANY
FOR SALE BY
(P. O. Box 5439.)
18 WILLIAM STREET,
NEW YORK.

Light Locomotives for use in Collieries, Mines, etc.
march 5 1y

Diamond-Pointed STEAM DRILLS.

Recent improvements in connection with the celebrated LESCHOT'S patents, have increased the adaptability of these drills to every variety of ROCK DRILLING. Their use, both in this country and in Europe, has sufficiently established their reputation for efficiency and economy, over any other now before the public.

The Drills are built of various sizes and patterns, WITH and WITHOUT BOILERS, and bore at a uniform rate of THREE TO FIVE INCHES PER MINUTE in hard rock.

They are adapted to CHANNELLING, GADDING, SHAFTING, TUNNELLING and open cut work; also to DEEP BORING for TESTING the VALUE of MINES and QUARRIES. TEST ORES taken out, show the character of mines at any depth. Used either with steam or compressed air. Simple and durable in construction and never need sharpening.

Manufactured by
THE AMERICAN DIAMOND DRILL CO.,
No. 61 Liberty street,
feb4.6m New York.